



Interactive Elearning Application

BIOLOGY

By A Group Of Supervisors

Main Book

FREE GIFT
NOT FOR SALE

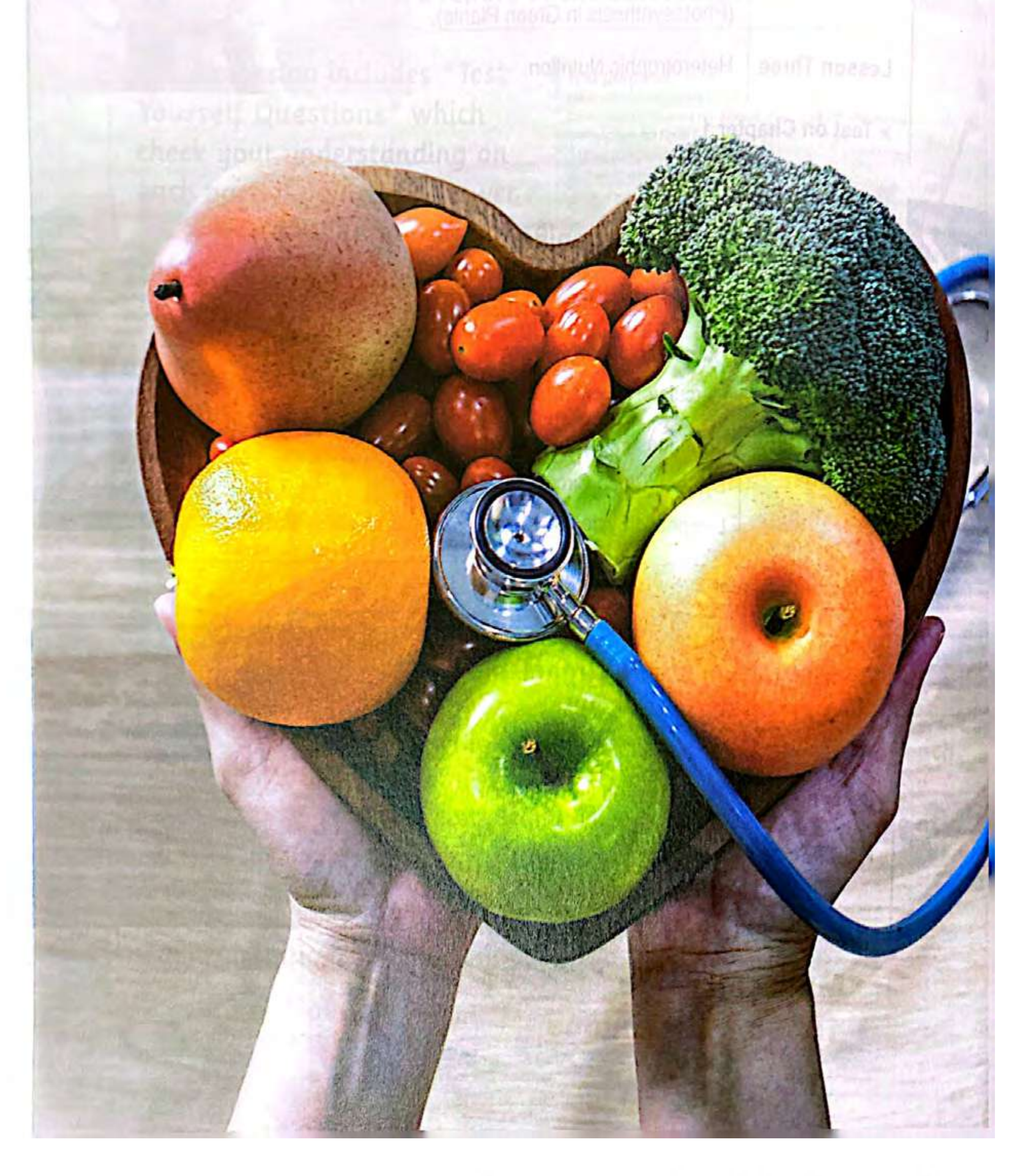
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FIRST TERM

CONTENTS

Structure and Function in Living Organisms

Chapter One

Nutrition and Digestion in Living Organisms



Lessons of the Chapter

Objectives of the chapter

By the end of this chapter, the student should be able to :

- Identify the concept of nutrition in living organisms.
- Differentiate between the heterotrophic and autotrophic nutritions.
- Mention the adaptation of root hair to perform its function.
- Explain the steps of photosynthesis.
- Identify the concept of nutrition in man.
- Illustrate the processes of digestion inside the organs of digestive system.
- Explain the process of absorption in small intestine.
- Explain the role of enzymes in the different digestion processes.
- Deduce the importance of food for human.



Chapter 1

Lesson One

Autotrophic Nutrition (Absorption of Water and Salts)

Nutrition

- Nutrition is one of the most important life characteristics that are varied in the living organisms.

Nutrition

It is the scientific study of food and various modes by which the living organisms feed.

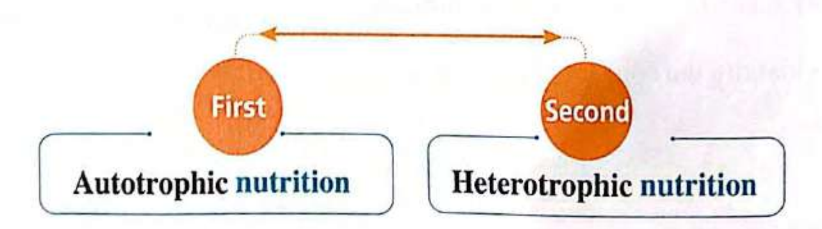
The importance of food for the living organism

1. It is the source of energy required to accomplish all the vital processes in the body of the living organism.
2. It constitutes the raw material needed for the growth and repair of the worn-out tissues.

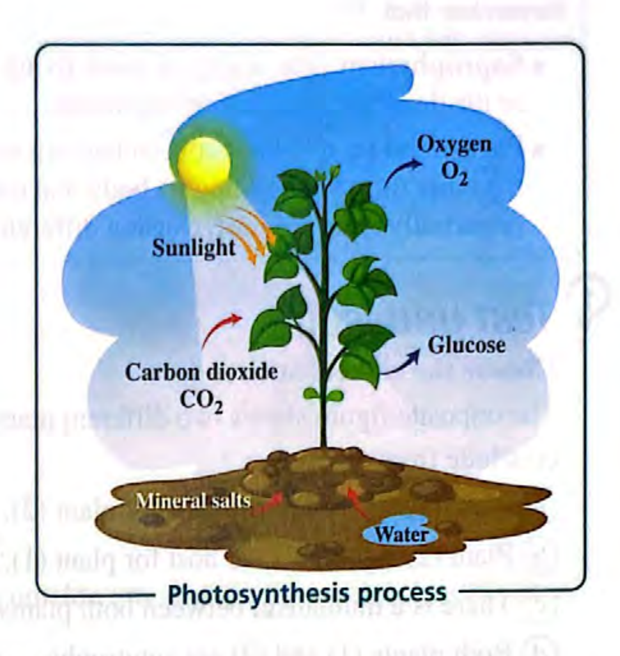
Types of nutrition



- **There are two types of nutrition, which are :**

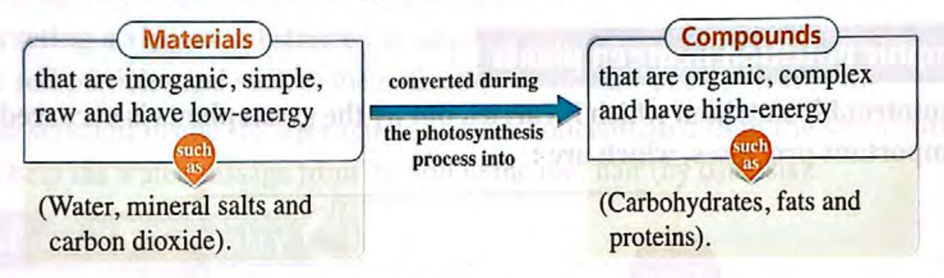


First Autotrophic nutrition



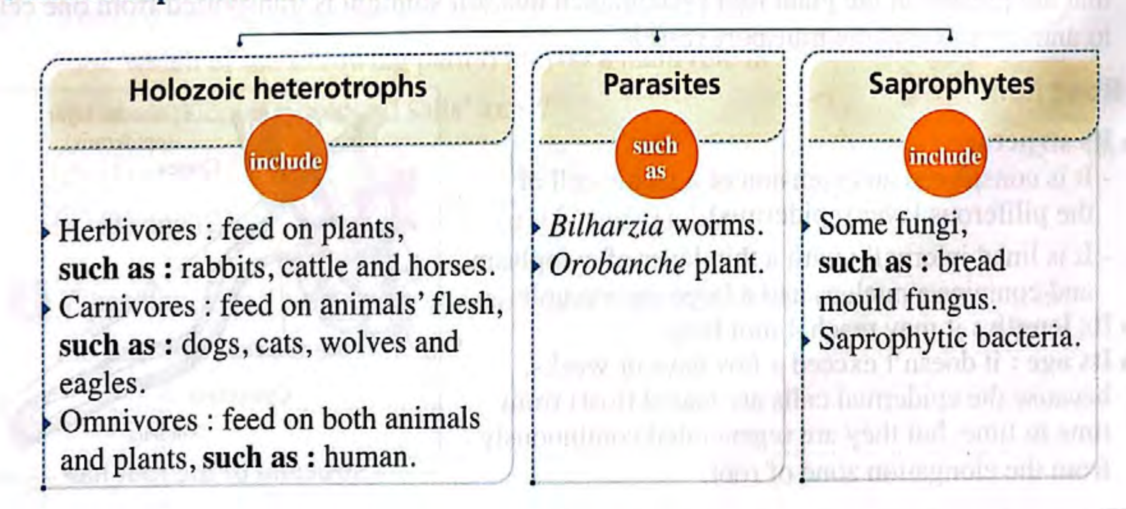
Photosynthesis process

- **Autotrophs** are organisms which manufacture their food by themselves through chemical reactions that occur inside their cells to synthesize the **high-energy complex organic food** compounds which are needed for their body building, such as : carbohydrates (sugar and starch), fats and proteins from **simple, raw and low-energy inorganic materials** such as : carbon dioxide, water and mineral salts from the surrounding environment by utilizing the light energy of the Sun to accomplish these chemical reactions which are called **"photosynthesis"**.
- **Examples :** Green plants – Some types of bacteria.



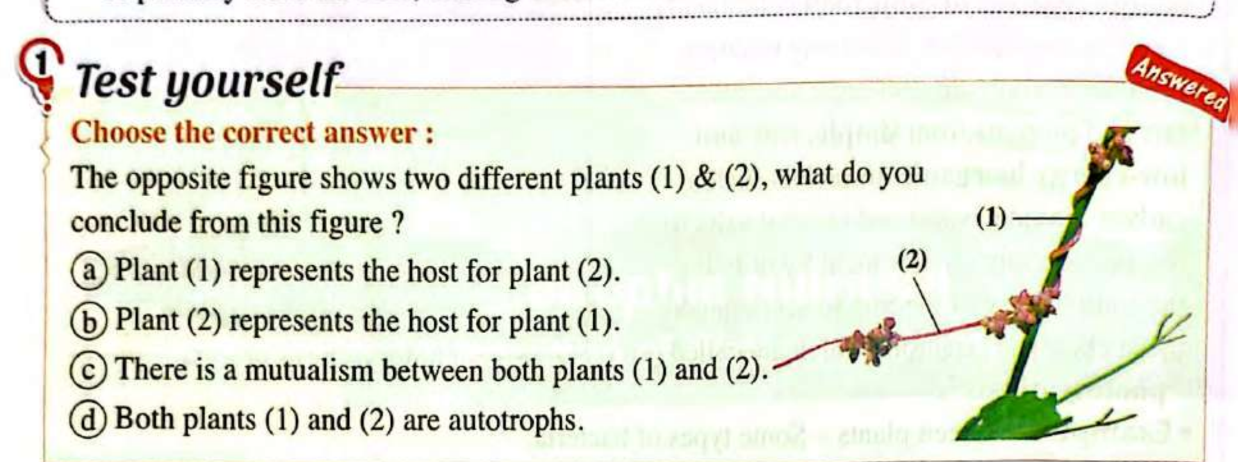
Second Heterotrophic nutrition

- **Heterotrophs** are organisms that obtain their food from the bodies of other living organisms (green plants or from the animals that have previously fed on plants) in the form of **high-energy complex ready organic compounds,** such as : proteins, carbohydrates and lipids.
- **Heterotrophs are classified into :**



Remember that

- **Saprophytism :** the ability of some living organisms to decompose the organic remains or the dead bodies of living organisms.
- **Parasitism :** a relation between two organisms, as one of them (parasite) depends on the other (host) in building its body and continuing its life by getting its food completely or partially from the host, causing different harms to the host.



1 *Test yourself*

Choose the correct answer :

The opposite figure shows two different plants (1) & (2), what do you conclude from this figure ?

ⓐ Plant (1) represents the host for plant (2).

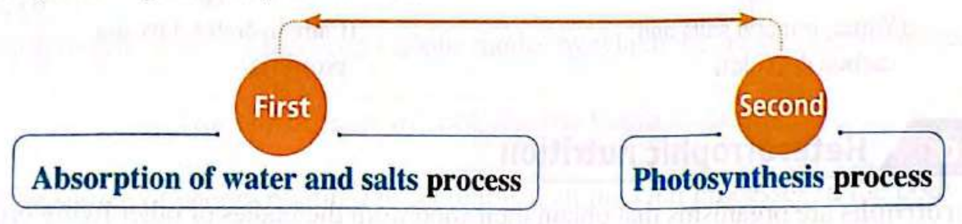
ⓑ Plant (2) represents the host for plant (1).

ⓒ There is a mutualism between both plants (1) and (2).

ⓓ Both plants (1) and (2) are autotrophs.

Autotrophic nutrition in green plants

- **The autotrophic nutrition which is carried out by the green plants is occurred through two important processes, which are :**

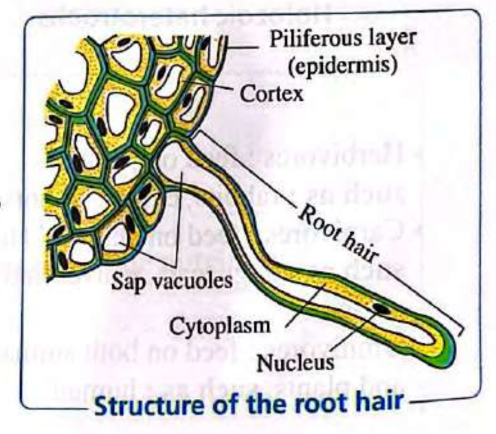


First Absorption of water and salts process

- The higher green plants absorb water and mineral salts from the soil through the root hairs that are present in the plant root system, then this soil solution is transported from one cell to another towards the transport vessels.

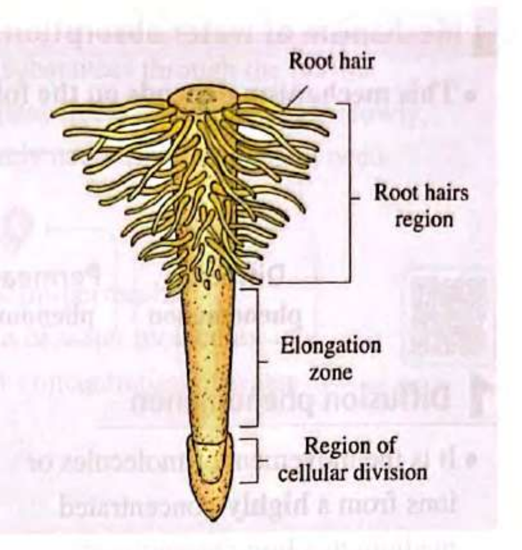
Root hair

- **Its structure :**
  - It is considered an extension of a single cell of the piliferous layer (epidermis).
  - It is lined internally with a thin layer of cytoplasm, and contains a nucleus and a large sap vacuole.
- **Its length :** it may reach 4 mm long.
- **Its age :** it doesn't exceed a few days or weeks, because the epidermal cells are teared (lost) from time to time, but they are regenerated continuously from the elongation zone of root.



Structure of the root hair

Do you know... ?



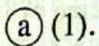
- On examining a longitudinal section in the plant root, we find that it consists of several important regions, **which are :**
  - Cellular division region.
  - Elongation zone that compensates the teared root hairs from time to time.
  - Root hairs region in which the root hairs appear as extensions of the piliferous layer cells.

- **Suitability of the root hair to its function :**

1. **Being large in number and protruding outside :** to increase the surface area of water and salts absorption.
2. **Having a thin wall :** to permit the passage of water and salts through it.
3. **Secreting a viscous substance :** to help these hairs to find their way easily among the soil particles and stick to them. So, they can fix the plant into the soil.
4. **The solution inside its sap vacuole is more concentrated than the soil solution :** To help the water passage from the soil to the root hair (by osmosis).

Integration with Chemistry 

Solution is a homogenous mixture between two substances, as one of them (solute) dissolves in the other (solvent).



Test yourself

Answered

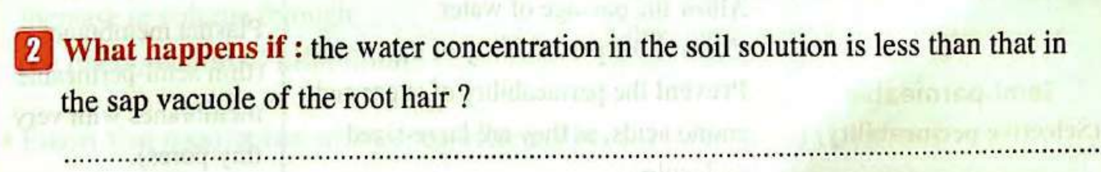
1 Choose the correct answer :

The opposite figure shows a transverse section in a plant root, which of the following part(s) play(s) a main role in the absorption of water and salts' ions ?

(2)
(1)
(3)

ⓐ (1). ⓑ (2).
ⓒ (1) and (2). ⓓ (1) and (3).

2 What happens if : the water concentration in the soil solution is less than that in the sap vacuole of the root hair ?

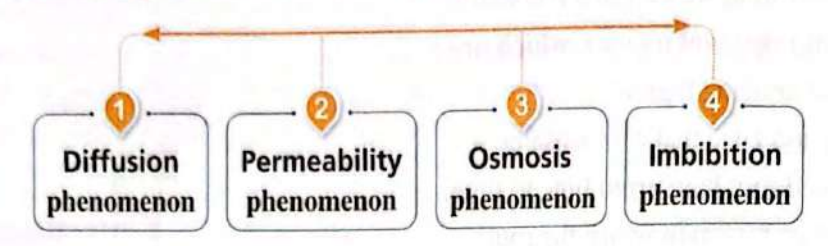


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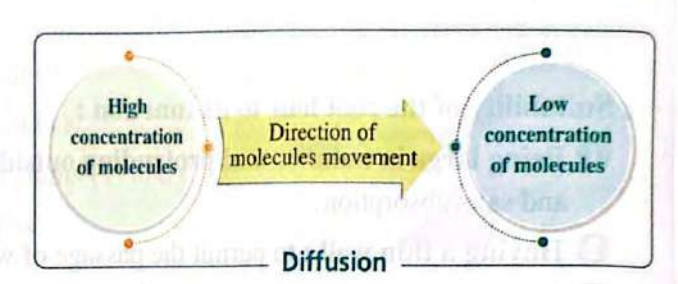
Mechanism of water absorption

- **This mechanism depends on the following physical phenomena :**



1 Diffusion phenomenon

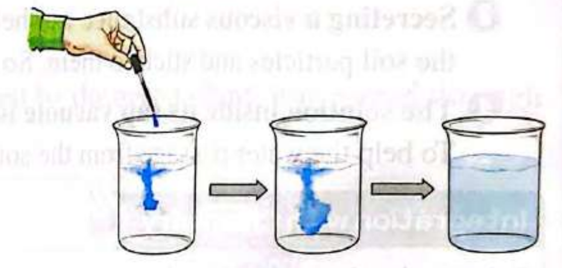
- It is the movement of molecules or ions from a **highly**-concentrated medium to a **low**-concentrated medium, due to the continuous self-motion of the molecules of the diffused substance.



Diffusion

- **Example :**

The diffusion of a drop of ink, when it falls into a beaker containing water.



2 Permeability phenomenon

- **The cell walls and membranes are different according to their permeability as follows :**

Walls and membranes	Ability of permeability	Examples
1 Permeable :	**Allow** water and mineral salts to pass.	Cellulose walls.
2 Impermeable :	**Don't** allow water and mineral salts to pass.	Walls covered by lignin or cutin or suberin.
3 Semi-permeable (Selective permeability) :	- **Allow** the passage of water. - **Control** the permeability of many salts. - **Prevent** the permeability of sugar and amino acids, as they are large-sized molecules.	Plasma membranes (thin semi-permeable membranes with very tiny pores).

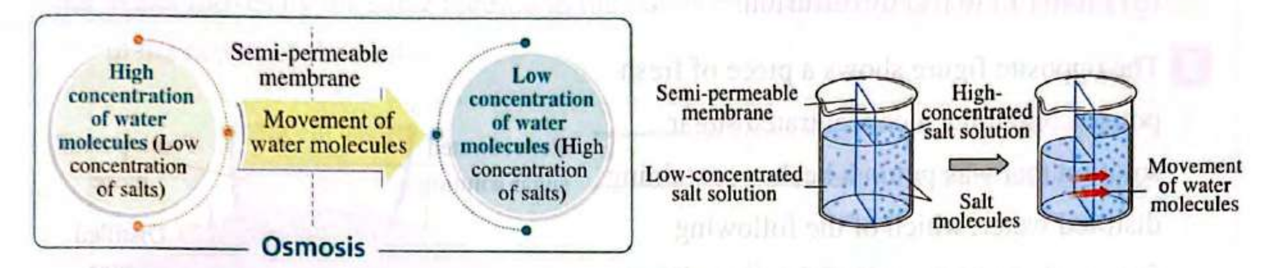
Selective permeability

It is the phenomenon which controls the passage of substances through the plasma membranes, where some substances are allowed to pass freely, and others pass slowly, and prevent the passage of other substances completely according to the plant need.

3 Osmosis phenomenon

- It is the passage (movement) of water through the semi-permeable membranes from a medium with **high** concentration of water molecules (low concentration of salts) to another one with **low** concentration of water molecules (high concentration of salts).

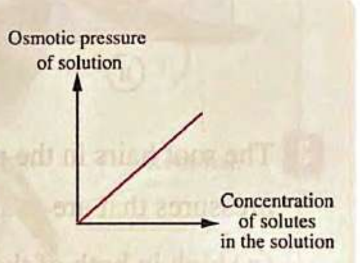




Osmotic pressure :

It is the pressure that causes the passage of water through the semi-permeable membranes, due to the difference in concentration of the dissolved substances (solutes) in water on the two sides of the membrane.

- The relation between the concentration of solutes in the solution and the osmotic pressure of the solution is **directly proportional relationship** (i.e. the osmotic pressure increases by increasing the concentration of solutes in the solution).



4 Imbibition phenomenon

- The plant cell walls absorb water through the solid particles, especially the colloidal ones that have the ability to absorb water, therefore they swell and increase in volume through **the phenomenon of imbibition.**

Life application :

Tissue papers are used in summer to dry the sweat, as they are made of cellulose substance which has the ability to absorb water (sweat) through the imbibition phenomenon.

- **From the examples of hydrophilic colloidal substances in plant :**

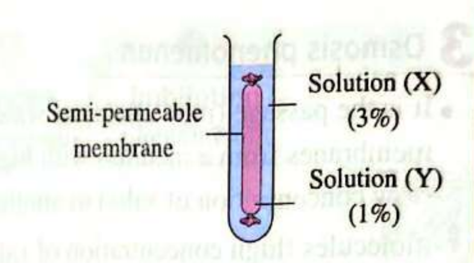
– Cellulose. – Pectin. – Protoplasmic proteins.

3 Test yourself

Answered

Choose the correct answer :

1 From the opposite figure, what is the direction of water transfer ?



ⓐ From (X) to (Y) by osmosis.

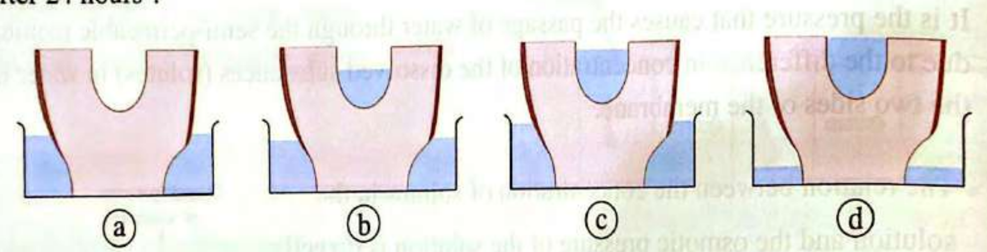
ⓑ From (Y) to (X) by osmosis.

ⓒ From (X) to (Y) by diffusion.

ⓓ From (Y) to (X) by diffusion.

2 The opposite figure shows a piece of fresh potato containing a concentrated sugar solution that was put in a beaker containing distilled water, which of the following figures shows the result of this experiment after 24 hours ?

Concentrated sugar solution
Fresh potato piece
Distilled water



3 The root hairs in the plants of salty and desert soils are characterized by osmotic pressures that are ....

ⓐ high in both of them.

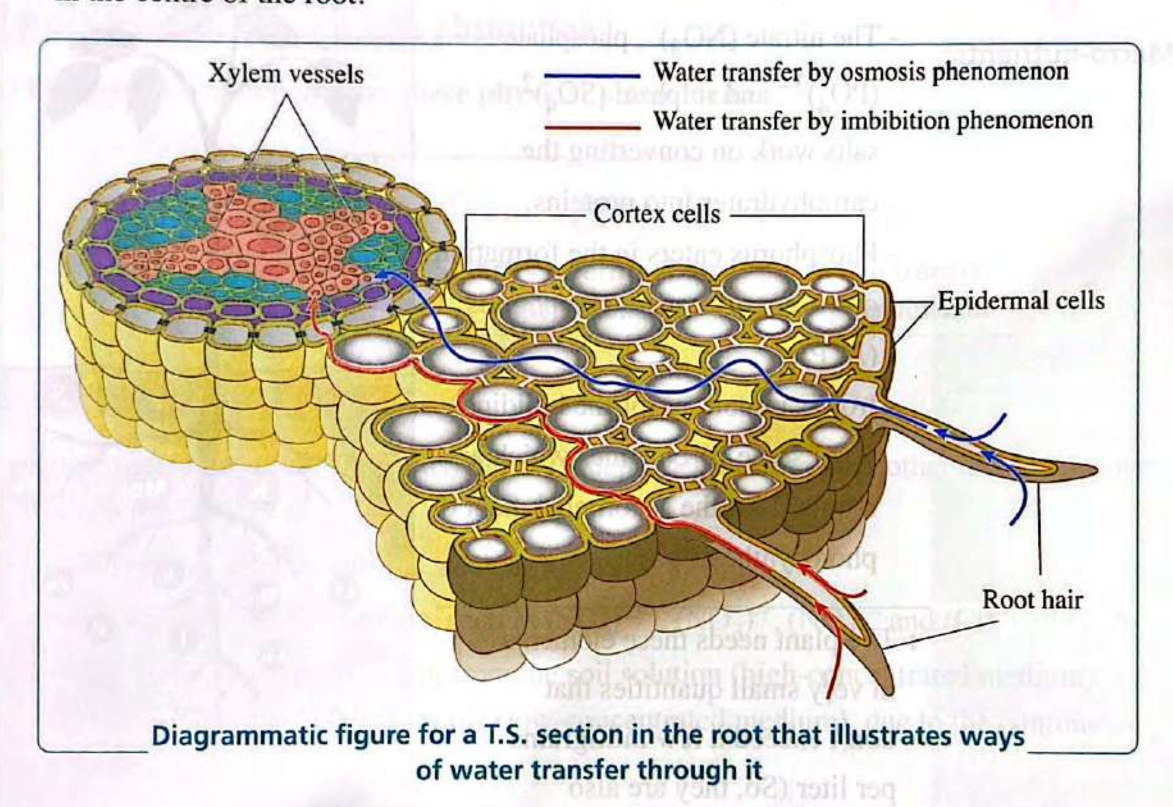
ⓑ low in both of them.

ⓒ high in salty plants and low in desert plants.

ⓓ high in desert plants and low in salty plants.

Explanation of water absorption by the root

1. The root hairs are covered by a **thin colloidal** layer to which the soil particles containing water and solutes adhere, so that the cellulose and plasma walls will absorb water by **imbibition phenomenon**.
2. Water moves from the soil to the epidermal cells by **osmosis phenomenon,** where the cellular sap of root hair is more concentrated than the soil solution, due to the presence of dissolved sugar in the cellular sap, (**i.e.** the water molecules concentration in the soil solution is **higher** than that in the sap vacuole).
3. Water moves by the same method to the cortex cells, until it reaches the xylem vessels in the centre of the root.



Diagrammatic figure for a T.S. section in the root that illustrates ways of water transfer through it

Absorption of mineral salts

- The scientists had proved that the plant needs other certain essential elements, besides **carbon (C)**, **hydrogen (H_2)** and **oxygen (O_2)**, and it can absorb these elements through roots, and their shortage **leads to :**

- A disturbance in the plant vegetative growth or its stop completely.

OR

- The non-formation of flowers or fruits.

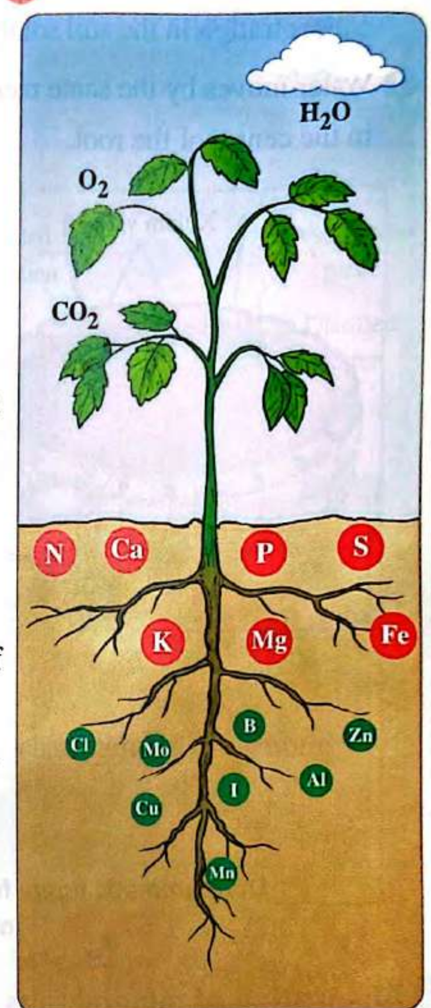


- **The essential food elements for green plants are divided into two groups, as follows :**

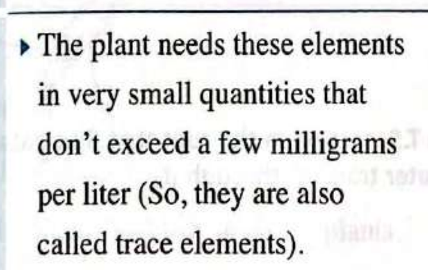
1 Macro-nutrients

- The plant needs these elements in a considerable quantities.
- **Their number :** they are seven elements, which are :

  - Nitrogen (N) - Phosphorus (P) 
  - Potassium (K) - Calcium (Ca) 
  - Magnesium (Mg) - Sulphur (S)
  - Iron (Fe)



- **Their importance :**
  - The nitrate $(NO_3)^-$, phosphate $(PO_4)^{3-}$ and sulphate $(SO_4)^{2-}$ salts work on converting the carbohydrates into proteins.
  - Phosphorus enters in the formation of the energy carrier compounds (ATP).
  - Iron is important for the building-up of some co-enzymes which are required for the accomplishment of photosynthesis process.





2 Micro-nutrients

- The plant needs these elements in very small quantities that don't exceed a few milligrams per liter (So, they are also called trace elements).
- **Their number :** they are eight elements, which are :

  manganese (Mn), zinc (Zn), boron (B), aluminum (Al), chlorine (Cl), copper (Cu), molybdenum (Mo) and iodine (I)

- **Their importance :**

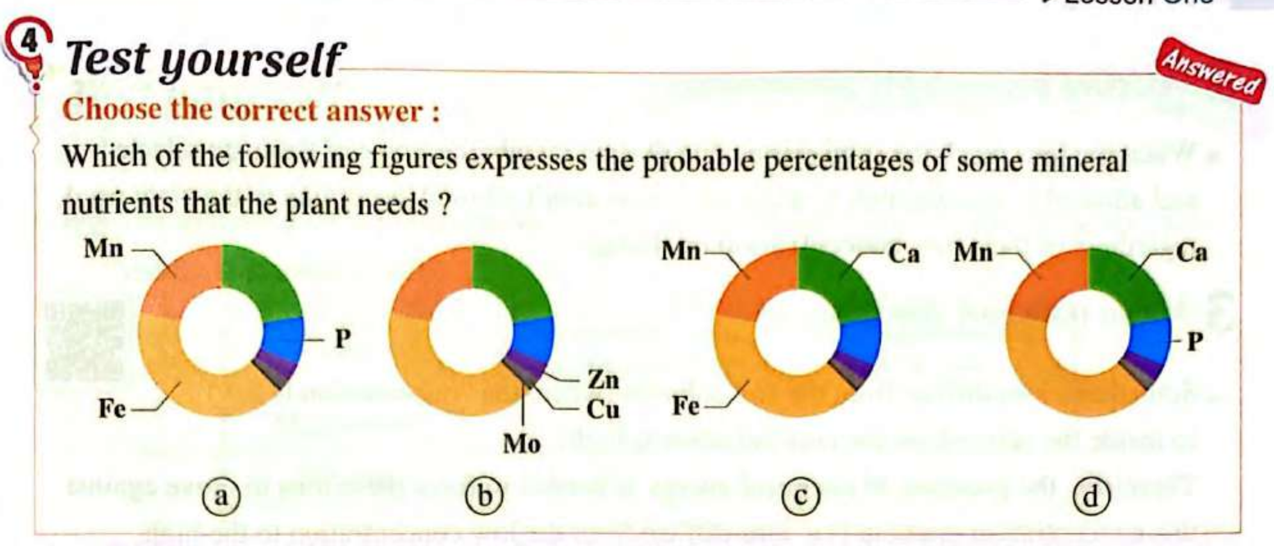
  Some of these elements work as activators for enzymes.

4 Test yourself

Answered

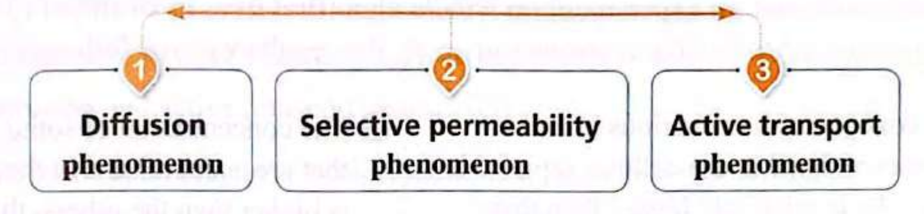
Choose the correct answer :

Which of the following figures expresses the probable percentages of some mineral nutrients that the plant needs ?



Mechanism of mineral salts absorption

This mechanism depends on these physical phenomena :



1 Diffusion phenomenon

- Solute molecules (elements' ions) diffuse independently from each other and from water itself in the form of :
  - **Positive ions :** called **cations**, such as K^+ and Ca^{2+}
  - **Negative ions :** called **anions**, such as $(SO_4)^{2-}$, $(NO_3)^-$, $(NO_2)^-$ and $(Cl)^-$
- These solutes move by diffusion from the soil solution (high-concentrated medium) and pass through the cellulose walls (low-concentrated medium), due to the continuous movement of free ions.
- Under certain conditions, cations exchange may take place through the cell membrane,

for example :

Sodium ion (Na^+) gets out of the cell and is replaced by potassium ion (K^+) .

Life application :

To get rid of the effects of the agricultural pesticides, it is recommended to soak vegetables in diluted salt solution or in water, while fruits are soaked in diluted sugar solution for a time period doesn't exceed ten minutes.

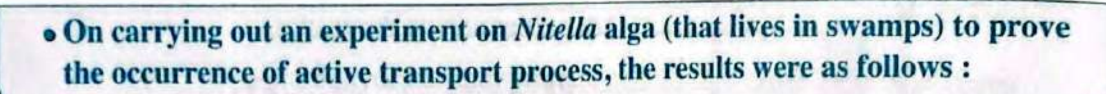
2 Selective permeability phenomenon

- When the ions reach the semi-permeable plasma membrane, some of them are selected and **allowed** to pass through it, while other ions aren't allowed, according to the plant need, regardless of their **size, concentration** or **charge**.

3 Active transport phenomenon

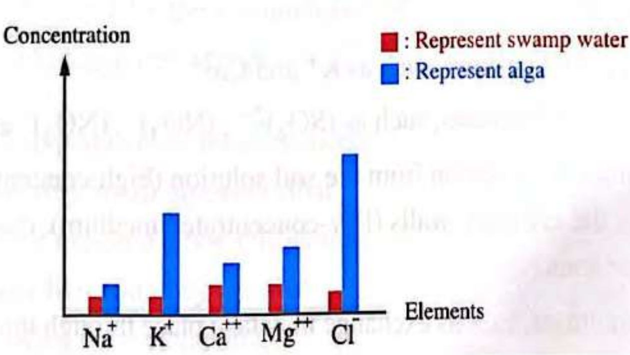


- Sometimes ions diffuse from the soil solution (where the concentration is low) to inside the cell (where the concentration is high).
Therefore, the presence of chemical energy is needed to force these ions to move against this concentration gradient (**i.e.** ions diffuse from the low concentration to the high concentration) and the passage of any substance through the cell membrane, when it needs chemical energy, is known as **active transport**.



- **On carrying out an experiment on *Nitella* alga (that lives in swamps) to prove the occurrence of active transport process, the results were as follows :**

1. The concentration of various ions that are accumulated in the cellular sap of this alga cells is relatively higher than their concentration in the swamp water. Such case requires the cell to consume some energy to absorb these ions.
2. The concentration of some ions that are accumulated in the cell is higher than the others, this proves that the ions are selectively absorbed according to the cell need.



Graph illustrates the concentration of salts in the cells of *Nitella* alga and swamp water



Test yourself



Choose the correct answer :

1 The following table illustrates the concentrations of some salt ions inside the root hair and the surrounding soil :

Ions	The concentration inside the root hair	The concentration in the soil
Magnesium	75	15
Nitrate	47	126

Which of the following physical phenomena does the plant depend on, in the absorption of magnesium and nitrate ions ?

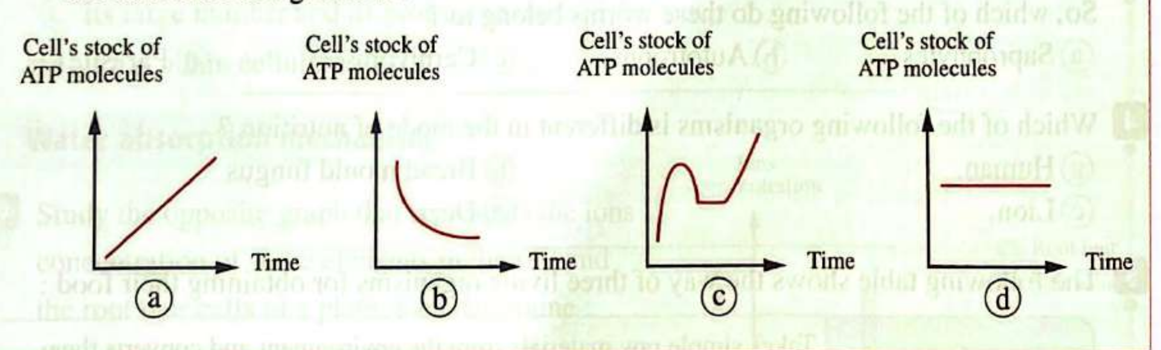
ⓐ Active transport only.

ⓑ Diffusion only.

ⓒ Active transport and diffusion respectively.

ⓓ Diffusion and active transport respectively.

2 Which of the following graphs represents the relation between the cells' stock of ATP molecules for an aquatic plant with time when some ions enter into its cells against the concentration gradient ?



Chapter 1

Questions on Lesson One

Autotrophic Nutrition

(Absorption of Water and Salts)



The questions signed by  are answered in detail. ● Understand ● Apply ● Analyze


Interactive te

First Multiple Choice Questions

Types of nutrition and the root hair

1 Which of the following characterizes the nutrients that are synthesized inside the cells of the green plant ?

ⓐ High-energy and simple-structured compounds.
ⓑ Low-energy and complex-structured compounds.
ⓒ High-energy and complex-structured compounds.
ⓓ Low-energy and simple-structured compounds.

2 Which of the following **doesn't** characterize the heterotrophs ?

ⓐ They obtain their food in the form of organic compounds.
ⓑ They obtain their food in the form of high-energy compounds.
ⓒ They obtain their food in the form of simple-structured compounds.
ⓓ They depend on other organisms to obtain their food.

3 If you know that *Bilharzia* worms live and feed inside the human hepatic portal vein. So, which of the following do these worms belong to ?

ⓐ Saprophytes. ⓑ Autotrophs. ⓒ Carnivores. ⓓ Parasites.

4 Which of the following organisms is different in the mode of nutrition ?

ⓐ Human. ⓑ Bread mould fungus.
ⓒ Lion. ⓓ Deer.

5 The following table shows the way of three living organisms for obtaining their food :

Organism (X)	Takes simple raw materials from the environment and converts them into complex organic substances.
Organism (Y)	Lives inside the alimentary canal of another organism and feeds on its digested food.
Organism (Z)	Lives growing in the places that are rich in organic substances.

Which of the following choices can represent organisms (X), (Y) and (Z) respectively ?

ⓐ *Ascaris* worm / Mushroom fungus / Corn plant.
ⓑ *Ascaris* worm / Corn plant / Mushroom fungus.
ⓒ Corn plant / *Ascaris* worm / Mushroom fungus.
ⓓ Corn plant / Mushroom fungus / *Ascaris* worm.

6 Which of the following characterizes the root hair cell from the other normal plant cells ?

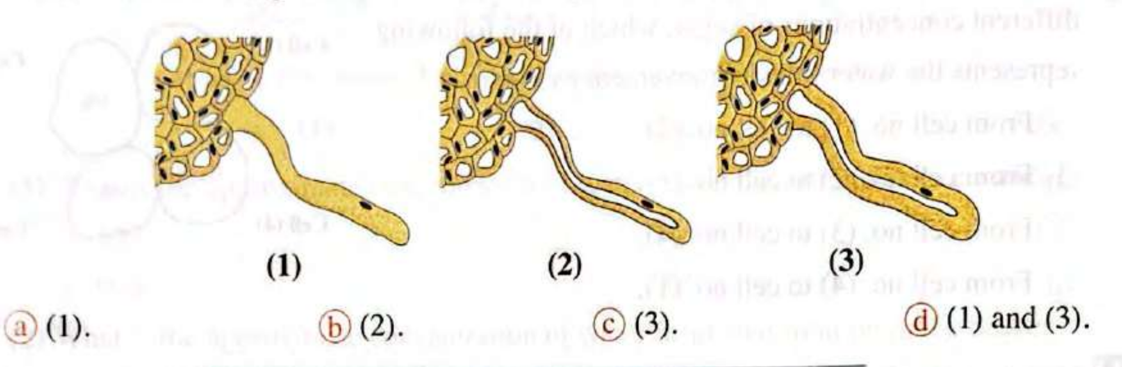
ⓐ The presence of cell membrane.

ⓑ The presence of sap vacuole.

ⓒ The presence of a layer of protoplasm.

ⓓ Increasing its surface area.

7 Which of the following root hairs has/have the greatest ability to absorb water from the soil ?



ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (1) and (3).

8 Which of the following has **no** relation with the suitability of the root hair to its function in absorbing water from the soil ?

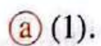
ⓐ The absence of cutin layer.

ⓑ The presence of large numbers of mitochondria.

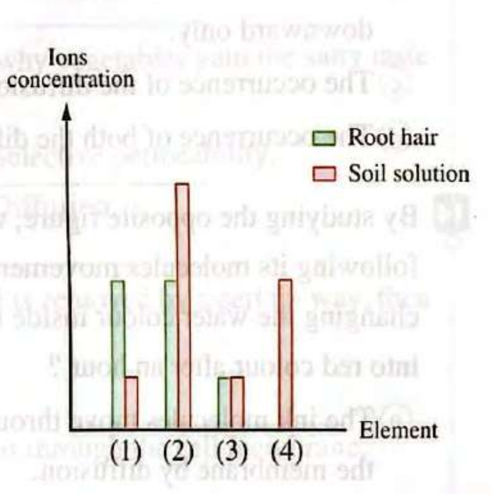
ⓒ Its large number and its protrusion outside the root.

ⓓ It has a thin cellulose wall.

Water absorption mechanism



9 Study the opposite graph that represents the ions concentration of some elements in the soil and the root hair cells of a plant, then determine : Which element is absorbed mainly by diffusion ?



ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

10 Which of the following food substances has/have the ability to pass through the plasma membranes of the cells ?

ⓐ Starch. ⓑ Calcium salts.

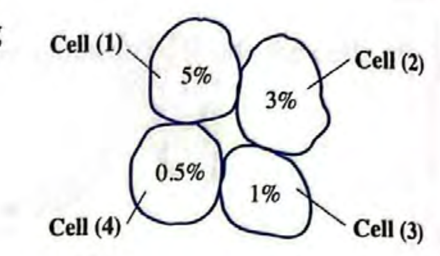
ⓒ Glycogen. ⓓ Protein.

11 A plant cell was put in a solution where it gained water by osmosis phenomenon. Which of the following represents the concentration of the cellular sap in each of the cell and the solution respectively ?

ⓐ 1% and 3%
ⓑ 1% and 1%
ⓒ 7% and 2%
ⓓ 2% and 7%

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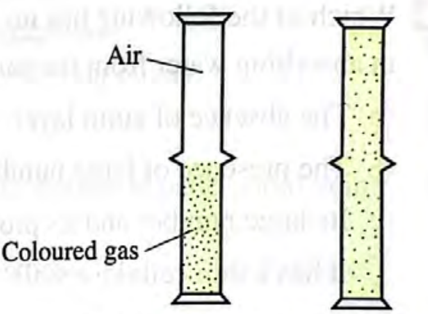
12 The opposite figure represents 4 adjacent cells that have different concentrations of sugar, which of the following represents the water transfer movement by osmosis ?



ⓐ From cell no. (1) to cell no. (2).
ⓑ From cell no. (2) to cell no. (3).
ⓒ From cell no. (3) to cell no. (4).
ⓓ From cell no. (4) to cell no. (1).

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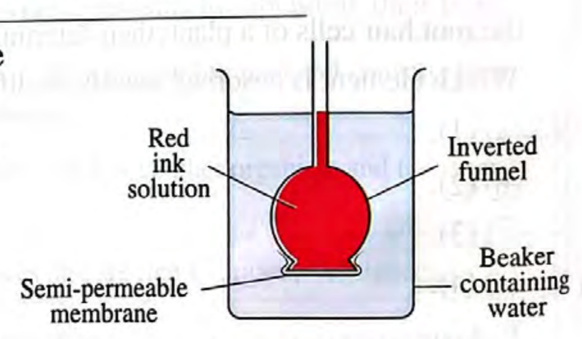
13 The opposite figure represents a lab experiment, at which a cylinder full of air is put above another cylinder full of a coloured gas, which of the following would explain what happened ?



ⓐ The occurrence of diffusion phenomenon upward and downward.
ⓑ The occurrence of the diffusion phenomenon downward only.
ⓒ The occurrence of the diffusion phenomenon upward only.
ⓓ The occurrence of both the diffusion and osmosis phenomena.

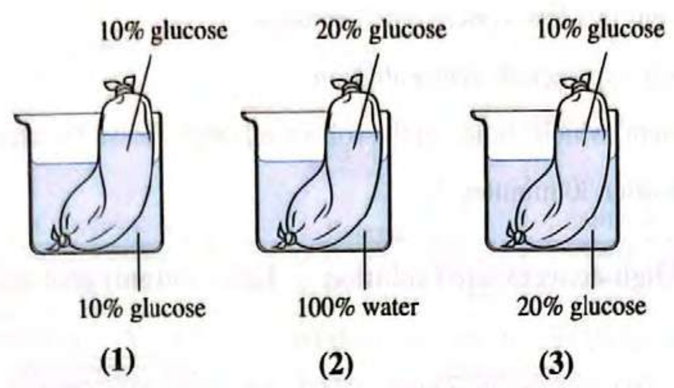
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14 By studying the opposite figure, which of the following its molecules movement leads to changing the water colour inside the beaker into red colour after an hour ?



ⓐ The ink molecules move through the membrane by diffusion.
ⓑ The ink molecules move through the membrane by osmosis.
ⓒ The water molecules move through the membrane by diffusion.
ⓓ The water molecules move through the membrane by osmosis.

15 In the following figure, a cellulose sac was put as shown in the cases (1), (2) and (3) at the beginning of the experiment :



(1) What is the approximate concentration of water inside the cellulose sac in case (1) ?

ⓐ 10% ⓑ 20%

ⓒ 80% ⓓ 90%

(2) What is the approximate concentration of water inside the solution in the beaker in case (3) ?

ⓐ 10% ⓑ 20%

ⓒ 80% ⓓ 90%

(3) What is the approximate concentration of glucose inside the solution in the beaker in case (2) ?

ⓐ 0% ⓑ 20%

ⓒ 80% ⓓ 100%

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16 What is the phenomenon which explains the reason why vegetables gain the salty taste when being cooked ?

ⓐ Imbibition. ⓑ Selective permeability.

ⓒ Active transport. ⓓ Diffusion.

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17 What do you expect when the cell wall of a plant cell is removed by a certain way, then put it in distilled water ?

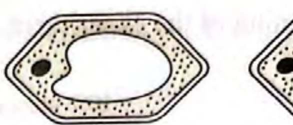
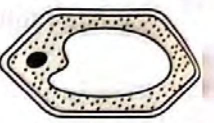
ⓐ The cell takes a longer time to swell.

ⓑ The proteins that are present in the cytoplasm exit through the cell membrane.

ⓒ The cell shrinks.

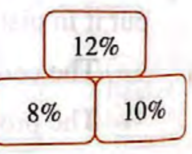
ⓓ The cell bursts.

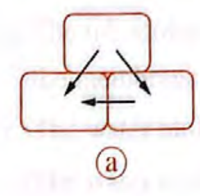
18 The opposite figure represents two identical cells, one of them is put in a high-concentrated solution and the other is put in a low-concentrated solution with respect to the sap vacuole concentration inside each of them, which choice in the following table shows the changes that happened for the two cells after 30 minutes ?

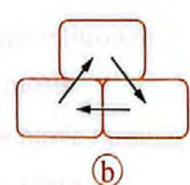



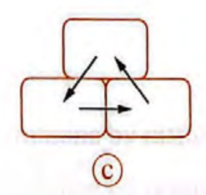
	High-concentrated solution	Low-concentrated solution
ⓐ		
ⓑ		
ⓒ		
ⓓ		

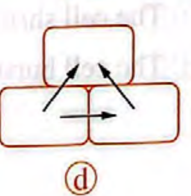
19 The opposite figure shows the concentration of the cellular sap inside three adjacent plant cells, which of the following choices shows the path of the water transport among these cells ?



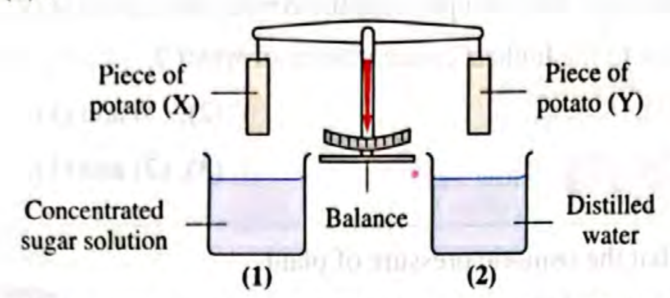

ⓐ


ⓑ


ⓒ


ⓓ

20 In the following figure, two pieces of potatoes have the same weight at an equilibrium state on the shown balance, what happens when both of them are immersed in beakers (1) and (2) ?

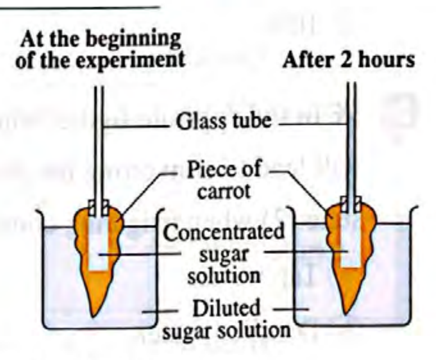


ⓐ The weight of piece (X) increases and the weight of piece (Y) isn't affected.
ⓑ The weight of piece (X) decreases and the weight of piece (Y) isn't affected.
ⓒ The weight of piece (X) increases and the weight of piece (Y) decreases.
ⓓ The weight of piece (X) decreases and the weight of piece (Y) increases.

21 What happens when immersing a plant cell in a solution with low osmotic pressure 1% with respect to the cell concentration ?

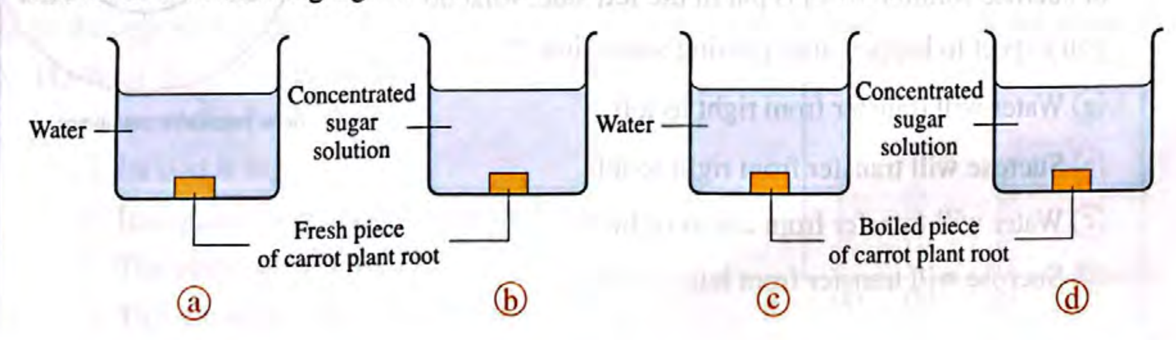
ⓐ It swells. ⓑ It shrinks. ⓒ It bursts. ⓓ It isn't affected.

22 The opposite figure shows the rising of a concentrated sugar solution inside a glass tube connected firmly inside a hollow piece of carrot that is put in a diluted sugar solution, what is the reason for the rising of this solution inside this tube ?

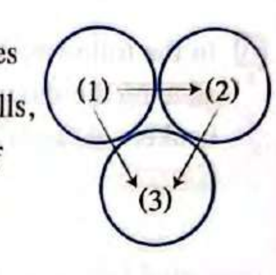


ⓐ The sugar molecules move through the carrot tissues to the glass tube.
ⓑ The sugar molecules move through the carrot tissues to the beaker.
ⓒ The water molecules move through the carrot tissues to the glass tube.
ⓓ The water molecules move through the carrot tissues to the beaker.

23 A student brought four equal-sized pieces of carrot plant root, then they were treated as shown in the following figures for 4 hours, which piece will be the smallest in size ?



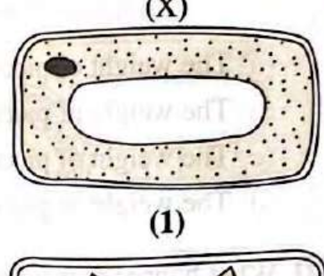
24 ❋ The opposite figure represents the direction of the water molecules transfer by osmosis phenomenon among three neighbouring plant cells, which of the following choices represents the correct arrangement of cells from the least to the highest concentration of water ?

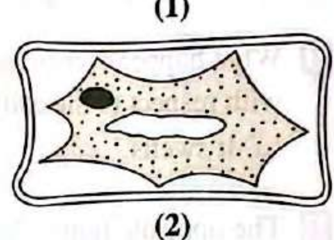


ⓐ (2), (1) and (3). ⓑ (2), (3) and (1).
ⓒ (1), (2) and (3). ⓓ (3), (2) and (1).

---

25 ❋ If you know that the osmotic pressure of plant cell (X) is equivalent to 5% sucrose solution. What is the concentration of sucrose solution that leads to converting the cell from state no. (1) into state no. (2), when putting in it ?

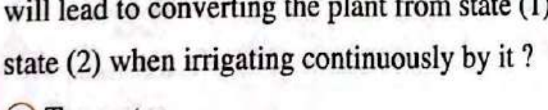


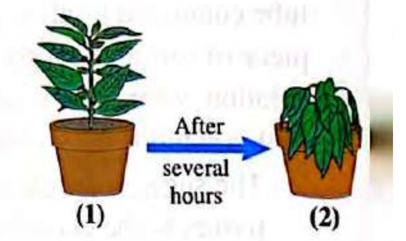


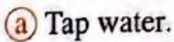
ⓐ 0%
ⓑ 1%
ⓒ 5%
ⓓ 10%

---

26 ❋ In the opposite figure, which of the following will lead to converting the plant from state (1) to state (2) when irrigating continuously by it ?



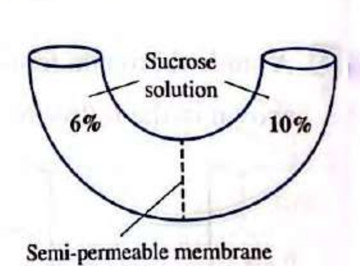




ⓐ Tap water.
ⓑ Distilled water.
ⓒ Low-concentrated sugar solution.
ⓓ Highly-concentrated salt solution.

---

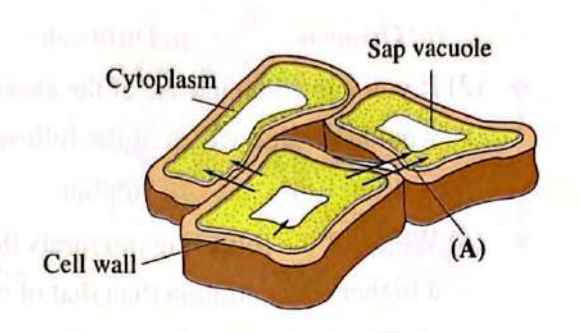
27 ❋ In the opposite figure, an amount of sucrose solution (10%) is put in the right side and another equal amount of sucrose solution (6%) is put in the left side, what do you expect to happen after passing some time ?



ⓐ Water will transfer from right to left.
ⓑ Sucrose will transfer from right to left.
ⓒ Water will transfer from left to right.
ⓓ Sucrose will transfer from left to right.

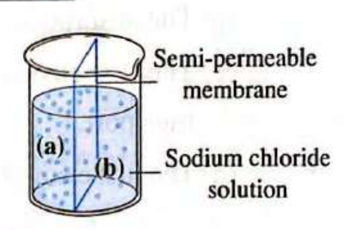
Absorption of mineral salts

28 From the opposite figure, what is the phenomenon by which substance (A) transfers among the cells ?



ⓐ Osmosis.
ⓑ Imbibition.
ⓒ Diffusion.
ⓓ Active transport.

29 In the opposite figure :



(1) What is the phenomenon by which the sodium ions move from (a) to (b) ?

ⓐ Osmosis. ⓑ Diffusion.
ⓒ Active transport. ⓓ Imbibition.

(2) What is the phenomenon by which the water molecules move from (b) to (a) ?

ⓐ Osmosis. ⓑ Diffusion. ⓒ Active transport. ⓓ Imbibition.

30 Which of the following elements is needed by the plant for protein synthesis ?

ⓐ Aluminum. ⓑ Nitrogen. ⓒ Molybdenum. ⓓ Chlorine.

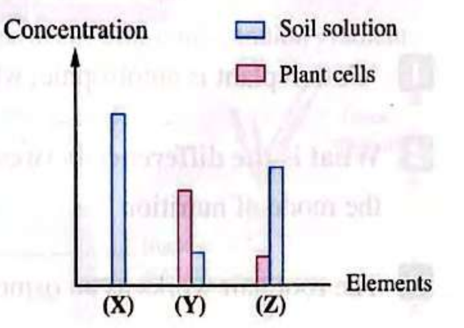
31 Which of the following elements is the least used by the plant ?

ⓐ Phosphorus. ⓑ Nitrogen. ⓒ Iodine. ⓓ Sulphur.

32 If the concentration of K^+ ions in the pond water is 1.2×10^3 ion/liter. What is the concentration of these ions in the cellular sap of *Nitella* alga if you know that the absorption of K^+ ions requires energy ?

ⓐ 1.2×10^3 ion/liter. ⓑ 0.8×10^3 ion/liter.
ⓒ 0.12×10^3 ion/liter. ⓓ 2.1×10^3 ion/liter.

33 In the opposite graph :



(1) What is the reason for the non-absorption of element (X) ?

ⓐ Its size is big.
ⓑ Its concentration is very high in the soil.
ⓒ The plant doesn't need it.
ⓓ This element is from the micro-nutrients.

(2) What is the phenomenon on which the plant depends for the absorption of element (Y) ?

ⓐ Osmosis. ⓑ Diffusion. ⓒ Active transport. ⓓ Imbibition.

(3) If you know that in case of the absence of element (Y), photosynthesis process wouldn't occur, which of the following may represent this element ?

ⓐ Iron. ⓑ Sulphur. ⓒ Chlorine. ⓓ Calcium.

(4) Which of the following interprets the reason for the presence of element (Y) in a higher concentration than that of element (Z) in the plant cells ?

ⓐ The plant needs element (Y) more than element (Z).

ⓑ The absorption of the two elements is occurred by diffusion.

ⓒ The first element is absorbed by diffusion and the second is absorbed by active transport.

ⓓ The first element is absorbed by active transport and the second is absorbed by diffusion.

---

34 Which of the following mechanisms permit the transport process inside and outside the cell ?

(1) Active transport. (2) Diffusion. (3) Selective permeability. (4) Osmosis.

ⓐ (2) and (4) only. ⓑ (1), (2) and (3) only.

ⓒ (1), (3) and (4) only. ⓓ (1), (2), (3) and (4).

---

35 * A piece of fresh potato is put in a diluted sucrose solution and after an hour, the weight of this piece increases. Which of the results shown in the opposite table represents the concentration of sucrose in the solution after the end of the experiment and the occurring process ?

	The concentration of sucrose	Process
ⓐ	Decreases	Active transport
ⓑ	Increases	Active transport
ⓒ	Decreases	Osmosis
ⓓ	Increases	Osmosis

Second Miscellaneous Questions

1 "Cotton plant is autotrophic, while bread mould fungus is heterotrophic". **Explain.**

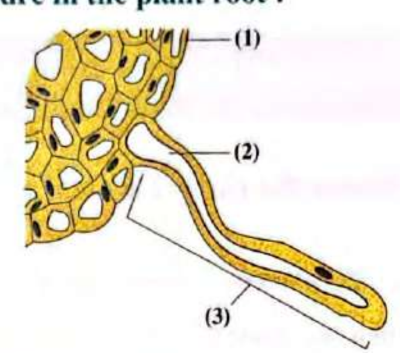
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2 **What is the difference between :** bean plant and *Orobanche* plant, according to the mode of nutrition ?

---

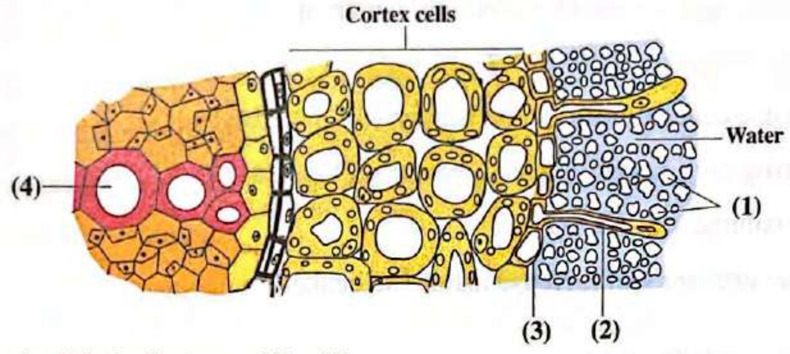
3 The root hair works as an osmotic device. **Explain.**

4 **The following figure illustrates an important structure in the plant root :**



- **(a) What** is the change that may occur to structures no. (1) and (3) in case of the continuous root growth ?
- **(b) What happens** to the ions concentration in structure no. (2), on increasing the time between the irrigation periods ?
- **(c) Predict what happens** in case of the absence of structure no. (3) from the plant root.

5 **The following figure illustrates a T.S. in the root of a plant :**



- **(a) Deduce** the labels from no. (1) : (4).
- **(b) Illustrate** by arrows on the figure the path of water transfer from structure no. (1), till reaching structure no. (4) in the centre of the root by osmosis phenomenon.
- **(c) Explain how the presence of structure no. (2) helps in :**
  1. Penetrating structure no. (1).
  2. Increasing the efficiency of water and salts absorption from structure no. (1).
- **(d) What happens if** the nitrate, sulphate and phosphate salts disappeared from structure no. (1) ?

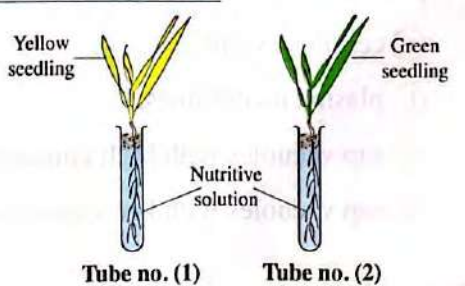
6 "The cell walls are characterized by the selective permeability phenomenon". **How far is this statement correct ? With explanation.**

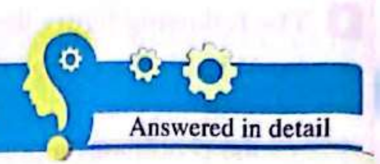
7 **Explain :** there is a relation between osmosis phenomenon and osmotic pressure.

8 "The osmosis difference among plant cells leads to transferring water by active transport". **How far is this statement correct ? With explanation.**

9 **Give reason for :** the cell consumes energy to absorb the ions against the concentration gradient.

10 In the two opposite figures, two seedlings are planted in two different nutritive solutions with exposing them to the same conditions. **Explain** the difference between the colour of the two seedlings in the two tubes no. (1) and (2).



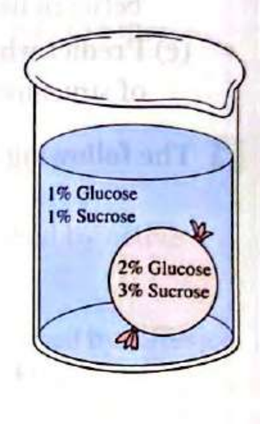


Questions that measure **high levels of thinking**

Answered in detail

Choose the correct answer :

1 A 2% glucose solution and a 3% sucrose solution were added in a sac made of a permeable membrane for water and glucose only, then this sac is put in a water beaker containing 1% glucose solution and 1% sucrose solution, which of the following will occur with time ?

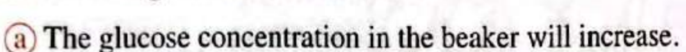


ⓐ The glucose concentration in the beaker will increase.

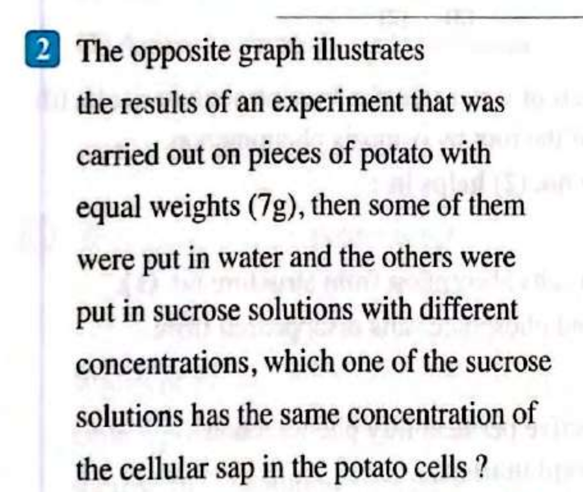
ⓑ The sucrose concentration inside the sac will increase.

ⓒ The sac volume will decrease.

ⓓ The water amount will increase inside the beaker.

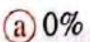


2 The opposite graph illustrates the results of an experiment that was carried out on pieces of potato with equal weights (7g), then some of them were put in water and the others were put in sucrose solutions with different concentrations, which one of the sucrose solutions has the same concentration of the cellular sap in the potato cells ?



ⓐ 0% ⓑ 2%

ⓒ 4% ⓓ 7%



3 The green plant doesn't get benefit from the sugars resulted from the decomposition of the plant leaves which are present in the soil, this is because the root hairs contain ....

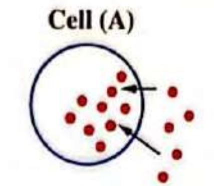
ⓐ cellulose walls.

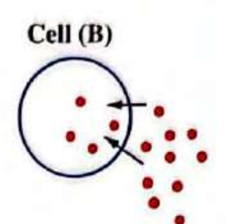
ⓑ plasma membranes.

ⓒ sap vacuoles with high concentration of sugar.

ⓓ sap vacuoles with low concentration of sugar.

4 From the opposite figure, which of the following cells need(s) ATP molecules to transfer the molecules to it ?





ⓐ Cell (A) only. ⓑ Cell (B) only.
ⓒ Cell (A) and cell (B). ⓓ None of them uses ATP molecules.

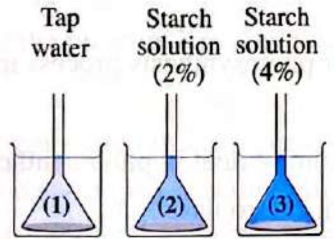
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5 Which of the following elements is needed by the plant to absorb ions against the concentration gradient ?

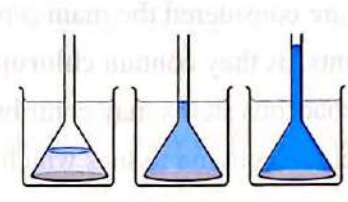
ⓐ Chlorine. ⓑ Iron. ⓒ Phosphorus. ⓓ Sulphur.

---

6 The following figure shows three funnels containing solutions with different concentrations, where each of them was put for 24 hours in a beaker containing starch solution with unknown concentration, and the end of each funnel is covered with a semi-permeable membrane :



At the beginning of experiment

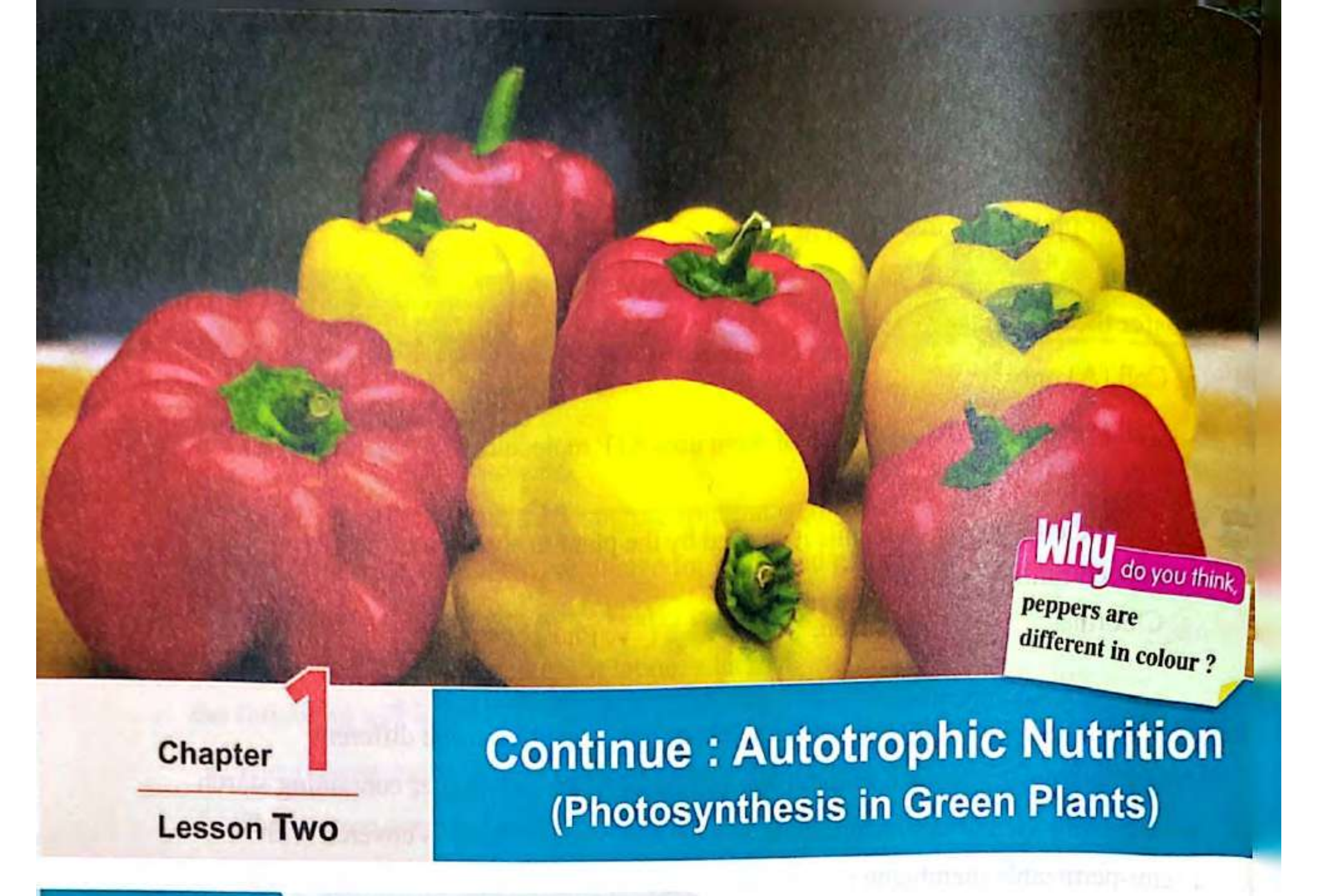

After 24 hours

(1) What is the concentration of the solution inside the beaker ?

ⓐ 4% ⓑ 2% ⓒ 1% ⓓ 0%

(2) What is the reason for the changes that occurred in funnels no. (1) and (3) ?

ⓐ Osmosis phenomenon. ⓑ Diffusion phenomenon.
ⓒ Imbibition phenomenon. ⓓ Active transport phenomenon.



Chapter 1

Lesson Two

Continue : Autotrophic Nutrition (Photosynthesis in Green Plants)

Second Photosynthesis process



- Green leaves are considered the main centres for photosynthesis process in the higher plants, as they contain **chloroplasts**.
- The green herbaceous stems may contribute to some extent in photosynthesis process, as they contain chlorenchyma tissues which contain chloroplasts.

Do you know...?

- Chlorenchyma tissues are parenchyma tissues containing green chlorophyll.

Chloroplast



Under the light microscope

The green plastids (chloroplasts) in higher plants appear as a homogeneous mass, having the shape of convex lens.



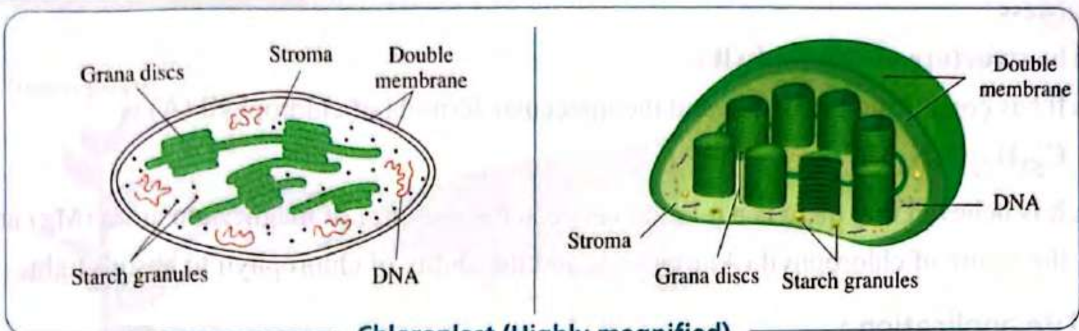
Chloroplasts

Integration with Physics



The presence of the green plastid in the form of a convex lens permits the collection of a larger amount of light rays which increases its efficiency to perform the photosynthesis process.

By the electron microscope



Chloroplast (Highly magnified)

- **It is proved that the chloroplast consists of :**

1. **Double thin external membrane :** its thickness is about 10 nanometers.
2. **Matrix (Stroma) :** consists of a colourless protein substance.
3. **Starch granules :**
   - They spread in the stroma with large numbers.
   - They are small in size, as they decompose into soluble sugar that translocated to other organs of the plant under certain conditions.
4. **Grana :**
   - They are embedded in the stroma.
   - They are disc-shaped structures arranged along the body of plastid, where they are linked together by thin membranes.
   - Each granum is about 0.5 micron in diameter and about 0.7 micron in thickness.
   - Each granum consists of 15 hollow discs or more that are arranged above each other and the granum is hollow from inside, while the margins of some discs of a granum may extend to meet the margins of another disc of a neighbouring granum to increase the surface area of grana that are exposed to light.
   - They are responsible for carrying the **pigments** which absorb the light energy "to perform the photosynthesis process".

- **The main pigments in the chloroplast :**

Pigment	Colour	Approximate ratio
Chlorophyll (A)	Bluish green	70%
Chlorophyll (B)	Yellowish green	
Xanthophyll	Lemon yellow	25%
Carotene	Orangish yellow	5%

Note

The green colour dominates over the other colours of pigments in the chloroplast, due to the high ratio of chlorophyll pigments.

- **The importance of chlorophyll :** it absorbs the light energy required for the photosynthesis process.
- **The structure of chlorophyll :**
  - It has complicated structure and the molecular formula of chlorophyll (A) is $C_{55}H_{72}O_5N_4Mg$
  - It is believed that there is a relation between the presence of magnesium atom (Mg) at the centre of chlorophyll (A) molecule and the ability of chlorophyll to absorb light.

Life application :

The pepper colours are different according to the various pigments that are found in its cells where :

* The green pepper fruits contain a high percentage of green chlorophyll.
* The yellow pepper fruits contain a high percentage of xanthophyll.
* The orange pepper fruits contain a high percentage of carotene.



1 *Test yourself*

Answered

Choose the correct answer :

1 The opposite graph illustrates the percentages of pigments that are present in a leaf of a plant, study it, then answer :

Percentage (%)
70, 60, 50, 40, 30, 20, 10, 0
Pigments
(X) (Y) (Z)

(1) By which of the following pigments the most light energy that is needed for the photosynthesis process is absorbed ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (Y) and (Z).

(2) Which of these pigments is found in a high percentage in the roots of carrot plant ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (X) and (Y).

(3) Which of these pigments is found in a high percentage in the stems of *Corchorus olitorius* "mulukhiyah" plant ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (Y) and (Z).

2 Which of the following elements affects the efficiency of chlorophyll absorption to light ?

ⓐ Mg ⓑ K ⓒ Na ⓓ Cl

Structure of the leaf



Structure of the leaf

- **The leaf consists of three main tissues, which are :**

1 Upper and lower epidermis

- Each of the upper and lower epidermises consists of one layer of adjacent barrel-shaped **parenchyma cells** that are devoid of chlorophyll.
- The external wall of each epidermis is coated by a layer of cutin, except the stomata that spread throughout the epidermal cells.

2 Mesophyll tissue

- **It is located between the upper and lower epidermises, transversed by veins and consists of :**



Palisade layer

- It is perpendicular to the surface of the upper epidermis.
- It consists of one row of cylindrical and elongated parenchyma cells.
- Its cells are crowded by chloroplasts that arrange themselves in its upper part to receive the largest amount of light rays.



Spongy layer

- It is located below the palisade layer.
- It consists of irregular-shaped and loosely-arranged parenchyma cells with wide intercellular spaces.
- Its cells contain a lower number of chloroplasts than the palisade cells.

3 Vascular tissue

- It consists of **numerous vascular bundles** which extend inside the veins and venules, and the main vascular bundle of the leaf is found in the midrib.
- **The vascular bundle consists of :**
  - **Xylem vessels :** found in several vertical rows that are separated by xylem parenchyma (thin-walled) cells.
  - **Phloem :**
    - It follows the xylem toward the lower surface of the leaf.
    - It translocates the dissolved organic food substances that are formed in the mesophyll tissue to the different plant parts.

Test yourself



Choose the correct answer :

1. If the magnesium element is detected in a leaf of a plant, in which of the following will it be found in an excess amount ?
   (a) Upper epidermis. (b) Lower epidermis.
   (c) Palisade layer. (d) Spongy layer.

2. How far are these statements "cutin layer is absent in aquatic plants", "and its thickness decreases in desert plants" correct ?
   (a) The two statements are correct. (b) The two statements are wrong.
   (c) The first statement is correct and the second statement is wrong.
   (d) The first statement is wrong and the second statement is correct.

Mechanism of photosynthesis

Source of the evolved oxygen during photosynthesis process


Van Neil

- The American scientist "**Van Neil**" was the first person who pointed out the source of the evolved oxygen in the photosynthesis process through his studies to this process in the **green and purple sulphur bacteria.**

1 Green and purple sulphur bacteria

- **Sulphur bacteria are characterized by :**
  1. **Being autotrophic :** as they can synthesize their food by a bacteriochlorophyll (which is more simple-structured than the normal chlorophyll).
  2. **Living in swamps and ponds :** as hydrogen sulphide is abundant which is the source of hydrogen that is used by these bacteria to reduce CO_2, in order to build-up carbohydrates substances and release sulphur.

- **Van Neil assumed that :**
  - Light decomposes hydrogen sulphide into hydrogen and **sulphur** in light reactions :

$$12H_2S \xrightarrow[\text{Bacteriochlorophyll}]{\text{Light energy}} 12H_2 + 12S\downarrow$$

  - The resulted hydrogen reduces carbon dioxide into carbohydrates in dark reactions :

$$12H_2 + 6CO_2 \xrightarrow[\text{Bacteriochlorophyll}]{\text{Reduction}} C_6H_{12}O_6 + 6H_2O$$

So, the general chemical equation for photosynthesis in sulphur bacteria is

$$6CO_2 + 12H_2S \xrightarrow[\text{Bacteriochlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6H_2O + 12S\downarrow$$

2 Green plants

- **Van Neil assumed that :**
  - Light decomposes water into hydrogen and **oxygen** in light reactions :

$$12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} 12H_2 + 6O_2\uparrow$$

  - The resulted hydrogen reduces carbon dioxide into carbohydrates in dark reactions :

$$12H_2 + 6CO_2 \xrightarrow[\text{Chlorophyll}]{\text{Reduction}} C_6H_{12}O_6 + 6H_2O$$

So, the general chemical equation for photosynthesis in green plants is

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$$

- **Consequently, Van Neil proposed that water is the source of oxygen in green plants, as hydrogen sulphide is the source of sulphur in sulphur bacteria.**

Confirming the theory of Van Neil

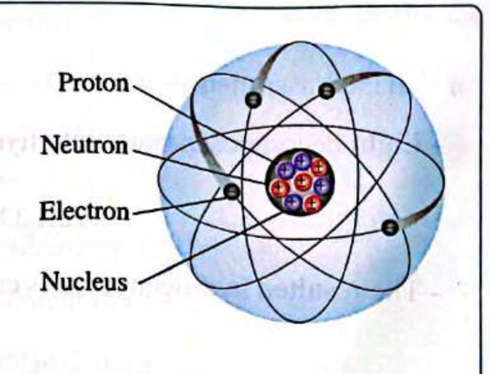
- **To confirm that water is the source of oxygen that evolved from the photosynthesis process :**

In 1941, a group of scientists at California university carried out experiments to verify the theory of "Van Neil", where they used the **green *Chlorella* alga** and provided it with all the suitable conditions for accomplishing the photosynthesis process.

	First experiment	Second experiment
Steps :	Using water contains oxygen isotope ^{18}O instead of ^{16}O	Using normal water with carbon dioxide contains ^{18}O isotope
Observations :	The evolved oxygen from photosynthesis is ^{18}O isotope.	The evolved oxygen from photosynthesis is normal oxygen ^{16}O
Equation of the reaction :	$6C\,^{16}O_2 + 12H_2\,^{18}O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}}$  $C_6H_{12}\,^{16}O_6 + 6H_2\,^{16}O + 6\,^{18}O_2\uparrow$	$6C\,^{18}O_2 + 12H_2\,^{16}O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}}$ $C_6H_{12}\,^{18}O_6 + 6H_2\,^{18}O_6 + 6\,^{16}O_2\uparrow$
Conclusion :	The source of the evolved oxygen from photosynthesis is water not carbon dioxide.	

Integration with Chemistry

Isotopes are forms of the chemical element that have the same atomic number (the number of protons inside the nucleus or the number of electrons that revolve around the nucleus), but they differ in the mass number (the sum of protons and neutrons inside the nucleus), due to the difference in neutrons number.

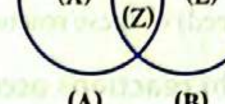


Example : oxygen has three stable isotopes which are :

^{16}O , ^{17}O and ^{18}O



Test yourself



Choose the correct answer :

1 The opposite figure represents the products of photosynthesis process of two living organisms (A) and (B), if you know that :

(X) (Y) (Z) (L) (A) (B)

(A) : An autotrophic organism that lives in a salty swamp that is rich in sulphur element.

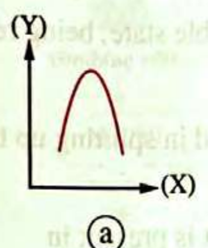
(B) : An autotrophic organism that lives in a mud soil.

Which of the following represents (X) and (Y) respectively ?

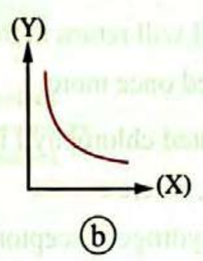
ⓐ Oxygen / Water. ⓑ Sulphur / Glucose.

ⓒ Oxygen / Glucose. ⓓ Sulphur / Oxygen.

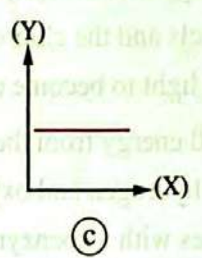
2 Which of the following graphs illustrates the relation between the precipitated sulphur (Y) in the swamps water and the percentage of the presence of purple sulphur bacteria (X) that found in it ?



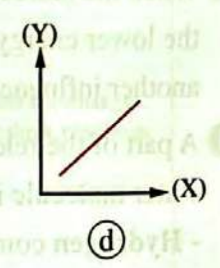
ⓐ



ⓑ



ⓒ



ⓓ

3 When using carbon dioxide containing oxygen isotope (^{18}O) in the photosynthesis process, which of the following will contain the oxygen isotope (^{18}O) in the products of the reaction ?

ⓐ Glucose only. ⓑ Glucose and water.

ⓒ Water only. ⓓ Water and the evolved oxygen.

Light and dark reactions of photosynthesis process

- In 1905, "**Blackman**" explained through his studying experiments on the limiting factors for the photosynthesis rate, such as light, temperature and carbon dioxide, the photosynthesis process is **divided into :**
  - Light reactions (sensitive to light).
  - Dark reactions "**Enzymatic reactions**" (sensitive to temperature).



Blackman

First Light reactions



Light reactions

They are a group of reactions that occur in the grana inside the green plastid (chloroplast), as it contains the chlorophyll pigments and the light is the limiting factor for the rate (speed) of these reactions.

- **Light reactions occur in a chain of steps, as follows :**

1. **Light** falls on the **chlorophyll** that is present in the grana of the chloroplast, therefore the electrons in the atoms of chlorophyll molecule will gain energy. So, they are shifted upward (transferred) from their low-energy levels to the higher ones.
2. The kinetic energy of light is stored as a chemical potential energy in the chlorophyll. So, the chlorophyll molecules in which their electrons have reached this condition are said to be in an "**excited state**" or "**activated state**".
3. When the stored energy in chlorophyll is released, the electrons fall once again to the lower energy levels and the chlorophyll will return to the stable state, being ready for another influence of light to become excited once more.
4. A part of the released energy from the excited chlorophyll is used in splitting up the water molecule into hydrogen and oxygen, where :
   - **Hydrogen** combines with a coenzyme (hydrogen receptor) that is present in the chloroplast and symbolized by NADP to give $NADPH_2$, in this way hydrogen will not escape or recombine with oxygen again.
   - **Oxygen** is released as a secondary product.
5. The other part of the released energy from the excited chlorophyll is stored in **ATP molecule** by the combination of ADP molecule (which is present in the chloroplast) with a phosphate group $(PO_4)^{3-}$, and this process is called "**photosynthetic phosphorylation**".

$$ADP + P \xrightarrow[\text{the activated chlorophyll}]{\text{Energy released from}} ATP$$

(Energy currency in the cell)

$$Adenosine-P\sim P + P \xrightarrow{E} Adenosine-P\sim P\sim P$$

- **ADP :** Adenosine DiPhosphate.
- **ATP :** Adenosine TriPhosphate that carries the energy to the dark reactions.
- **NADP :** Nicotinamide Adenine Dinucleotide Phosphate.

Sun
Light energy
absorbed by
Chlorophyll (A)
changed into
Active chlorophyll
Energy is used in
splitting
H_2O (Water)
2H
combine with
NADP
to give
$NADPH_2$
carries hydrogen to the dark reactions
O_2
evolved as a secondary product
converting
ADP → ATP
carries the energy to the dark reactions

A diagram summarizes the light reactions of the photosynthesis process

Second Dark reactions



Dark (Enzymatic) reactions

They are a group of reactions that occur in the stroma (matrix of chloroplast) outside the grana, in which the temperature is the limiting factor for the rate (speed) of these reactions. So, these reactions can occur in either light or darkness.

- In these reactions, **carbon dioxide gas is fixed** by its combination with the **hydrogen** carried on $NADPH_2$ compound with the help of the energy stored in ATP molecules, therefore carbohydrates are formed. So, $NADPH_2$ and ATP compounds are called **energy-fixing compounds.**

- **"Melvin Calvin"** and his associates at California university in 1949 revealed the nature of dark reactions by using the newly discovered radioactive isotope of carbon (^{14}C).


Melvin Calvin



Experiment Melvin Calvin

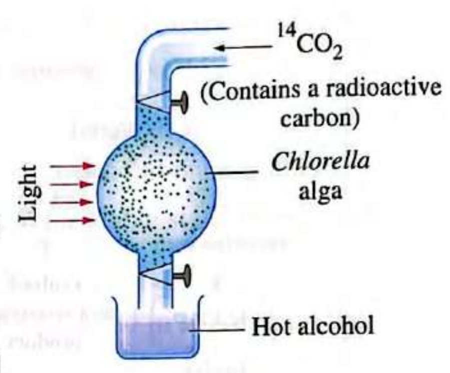
1. Steps :

(1) *Chlorella* alga was put in the apparatus shown in the figure.

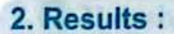
(2) He supplied the alga with CO_2 gas containing radioactive carbon (^{14}C).

(3) The apparatus was exposed to a very brief light of lamp **to allow the photosynthesis process to take place.**

(4) *Chlorella* was then immersed in a beaker containing hot alcohol **to kill the cell and stop the biochemical reactions.**



(5) He managed to separate the compounds that are formed during photosynthesis process (by special means) and tested for the radioactive carbon in these compounds by using Geiger counter.



2. Results :

(1) A compound with three carbon atoms (3C) was formed which is called "phosphoglyceraldehyde PGAL" when photosynthesis process continued for two seconds only and it is :

- The first stable chemical compound produced from photosynthesis process.
- Used in building-up glucose, starch, proteins and fats.
- Used in the cellular respiration as a high-energy compound.

(2) Proving that the hexose sugar (glucose) is not synthesized in one step, but synthesized through several intermediate reactions catalyzed by certain specific enzymes.

4 Test yourself



1 Choose the correct answer :

(1) When is water formed in the products of the following equation :

($6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$) ?

ⓐ During light reactions. ⓑ During dark reactions.

ⓒ During photosynthetic phosphorylation. ⓓ During light and dark reactions.

(2) What happens if the NADP compound is absent during the light reactions ?

ⓐ The splitting process of water doesn't occur.

ⓑ Hydrogen will transfer to the stroma.

ⓒ CO_2 gas isn't fixed up.

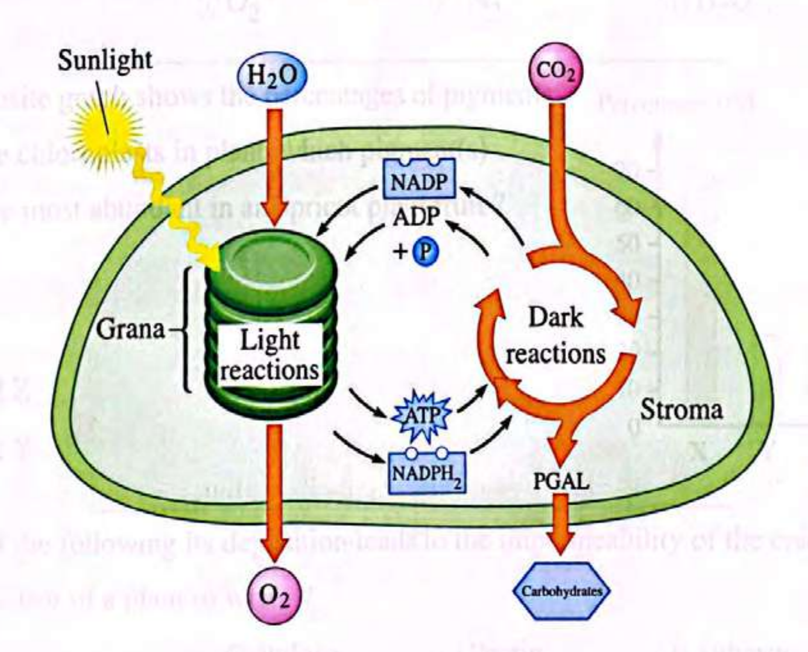
ⓓ The energy will not be transferred to the dark reactions.

2 During the photosynthesis process two molecules of phosphoglyceraldehyde are used to synthesize one molecule of glucose. **Explain.**

....

From the previous, we can :

- **Summarize the mechanism of occurrence of light and dark reactions in chloroplast, as shown in the following diagram :**



- **Compare between light and dark reactions, as follows :**

P.O.C.	Light reactions	Dark reactions
Location :	In grana.	In stroma (matrix of chloroplast).
The limiting factor :	Light	Temperature
What happens in this process :	Conversion of the kinetic energy of light into chemical potential energy in chlorophyll.	Fixation of CO_2 by its combination with hydrogen that is carried on $NADPH_2$ compound by the help of ATP
Products :	- Hydrogen combines with NADP, forming $NADPH_2$ - Oxygen gas (secondary product). - Energy stored in ATP molecule.	- PGAL compound that is used in building-up glucose, starch, proteins and lipids, also used as a high-energy compound in the cellular respiration. - Water.

Continue : Autotrophic Nutrition (Photosynthesis in Green Plants)



The questions signed by ✳ are answered in detail. ● Understand ● Apply ● Analyze



First Multiple Choice Questions

Chloroplast and the structure of the leaf

1 Which of the following tissues characterize the stems of herbaceous plants comparing to the stems of perennial trees ?

ⓐ Parenchyma tissues. ⓑ Collenchyma tissues.
ⓒ Sclerenchyma tissues. ⓓ Chlorenchyma tissues.

2 When exposing a plant to a sunny day, which of the following its releasing rate increases from the leaf ?

ⓐ CO_2 ⓑ O_2 ⓒ N_2 ⓓ H_2

3 When exposing a plant to a long period of darkness, which of the following its releasing rate increases from the leaf ?

ⓐ CO_2 ⓑ O_2 ⓒ N_2 ⓓ H_2O

4 The opposite graph shows the percentages of pigments inside the chloroplasts in plant, which pigment(s) is(are) the most abundant in an apricot plant fruit ?

ⓐ Z
ⓑ Y
ⓒ X and Z
ⓓ X and Y

Percentage (%)
70, 60, 50, 40, 30, 20, 10, 0
Pigments: X, Y, Z

5 Which of the following its deposition leads to the impermeability of the epidermal cell walls in a leaf of a plant to water ?

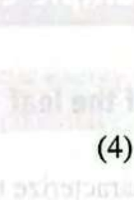
ⓐ Cutin. ⓑ Cellulose. ⓒ Pectin. ⓓ Suberin.

6 Through which of the following layers the light passes inside the bean plant leaf ?

ⓐ Layer that contains air chambers.
ⓑ Layer that is rich in plastids.
ⓒ Layer that is impermeable to water.
ⓓ Layer that contains vascular tissues.

---

7 In the opposite figure :



(1) In which of the following structures, the largest amount of carbohydrates is manufactured ?

ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

(2) In which of the illustrated parts in the figure the photosynthesis process takes place ?

ⓐ (1) and (4). ⓑ (1) and (3).
ⓒ (2) and (4). ⓓ (2) and (3).

(3) In which of the following parts the largest amount of CO_2 is used ?

ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (4).

---

8 Which of the following symptoms appear on growing the plant in a soil poor in magnesium element ?

ⓐ Small leaves and many roots grow.
ⓑ Large leaves and few roots grow.
ⓒ The leaves are getting greener.
ⓓ The leaves are getting more yellow in colour.

---

9 The following figures show some cells in a plant leaf that contains many green plastids, which of them indicates that the plant is exposed to a dim light ?


ⓐ


ⓑ

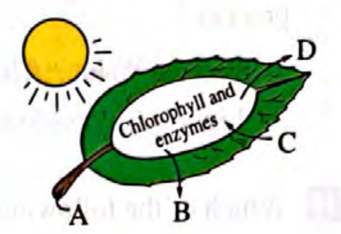

ⓒ


ⓓ



Mechanism of photosynthesis

10 Which of the following equations represents the nutrition process in the following figure ?



(a) $B + D \xrightarrow{Sunlight} A + C$

(b) $A + C \xrightarrow{Sunlight} B + D$

(c) $A + C \xrightarrow{Sunlight} A + D$

(d) $A + B + D \xrightarrow{Sunlight} B + C$

---

11 Which of the following interprets the inability of the green plants to survive in far depths of oceans ?

(a) There is no suitable soil to fix the plant roots.

(b) The concentration of oxygen is very high.

(c) The light intensity is very low.

(d) The concentration of carbon dioxide is very low.

---

12 Which of the following is(are) used by the green plants in the photosynthesis process ?

(a) Carbon dioxide and water to produce energy.

(b) Oxygen and water to produce energy.

(c) Energy to produce carbon dioxide and water.

(d) Energy to produce oxygen, water and glucose.

---

13 What is the factor that <u>**doesn't**</u> affect the rate of photosynthesis in the plant ?

(a) The number of plastids.

(b) The site of stomata.

(c) The thickness of the mesophyll tissue.

(d) The concentration of chlorophyll.

---

14 ✻ Which of the following equations is more suitable for expressing the photosynthesis process in green plants ?

(a) $6CO_2 + 6H_2O \xrightarrow[energy]{Light} C_6H_{12}O_6 + 6O_2\uparrow$

(b) $CO_2 + 2NADPH_2 + 3ATP + 2H_2O \xrightarrow[energy]{Light} \frac{1}{6}C_6H_{12}O_6 + 2NADP$

(c) $nC_6H_{12}O_6 \xrightarrow[energy]{Light} (C_6H_{12}O_6)_n + nH_2O$

(d) $6CO_2 + 12H_2S \xrightarrow[energy]{Light} C_6H_{12}O_6 + 6H_2O + 12S\downarrow$

Light and dark reactions

15 Which of the following is used by the green plants in the photosynthetic phosphorylation process ?

ⓐ Light + Water + Chlorophyll
ⓑ CO_2 + ADP + Light
ⓒ Light + Chlorophyll + ADP
ⓓ Water + CO_2 + ADP

16 Which of the following conversions is the opposite process to the photosynthetic phosphorylation process ?

ⓐ ATP from ADP in grana.
ⓑ ADP from ATP in grana.
ⓒ ATP from ADP in stroma.
ⓓ ADP from ATP in stroma.

17 Which of the following compounds **doesn't** belong to light reactions ?

ⓐ Splitting of H_2O
ⓑ Formation of glucose.
ⓒ Evolving of O_2
ⓓ Reduction of NADP

18 In the green plastid, ADP and NADP compounds are converted into ....

ⓐ energy carrier compounds.
ⓑ hydrogen carrier compounds.
ⓒ (a) and (b) respectively.
ⓓ (b) and (a) respectively.

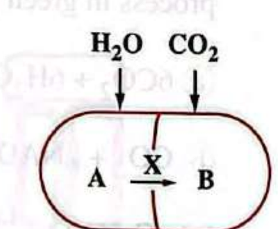
19 What is/are the source(s) of energy that is/are needed to fix CO_2 gas in the chloroplast ?

ⓐ CO_2 and H_2O
ⓑ ATP and NADP
ⓒ ATP
ⓓ H^+ ions and phosphate groups.

20 The dark reactions take place in the stroma in the presence of each of carbon dioxide, ...

ⓐ $NADPH_2$ and ATP
ⓑ NADP and ATP
ⓒ $NADPH_2$ and water.
ⓓ water and ATP

21 The opposite figure represents a reaction that happens inside an organelle in a plant leaf, where do the two processes (A) and (B) take place ?



ⓐ In grana and stroma respectively.
ⓑ In stroma and grana respectively.
ⓒ In grana.
ⓓ In stroma.

22 What is the main function of dark reactions in the green plastid ?

ⓐ Usage of ATP to release CO_2
ⓑ Usage of $NADPH_2$ to release CO_2
ⓒ Splitting of H_2O to release O_2
ⓓ Formation of simple sugars.

23 In the green and purple sulphur bacteria, what happens in the light and dark reactions respectively ?

ⓐ Formation of hydrogen sulphide / Splitting of water.
ⓑ Evolving of oxygen / Formation of water.
ⓒ Splitting of hydrogen sulphide / Formation of water.
ⓓ Splitting of water / Formation of hydrogen sulphide.

24 Which of the following its occurrence **isn't** related to the presence of $NADPH_2$ compounds in the stroma of the chloroplast ?

ⓐ Splitting of water molecule.
ⓑ Activation of chlorophyll.
ⓒ Formation of ADP
ⓓ Releasing of oxygen gas.

25 Which of the following reactions occurs in stroma and **doesn't** occur in grana ?

ⓐ Formation of a 3-carbon compound.
ⓑ Conversion of NADP into $NADPH_2$
ⓒ Splitting of water molecule.
ⓓ Conversion of ADP into ATP

26 In the dark reactions of photosynthesis process, how is PGAL compound formed ?

ⓐ By combination of carbon dioxide with water.
ⓑ By combination of carbon dioxide with hydrogen.
ⓒ By production of ATP from ADP
ⓓ By reaction between carbon dioxide and chlorophyll.

27 In an experiment similar to that of Melvin Calvin, CO_2 gas containing ^{16}O isotope and H_2O containing ^{18}O isotope were used, what is the product that is formed after four seconds ?

ⓐ PGAL containing ^{16}O
ⓑ Glucose containing ^{16}O
ⓒ Glucose containing ^{18}O
ⓓ PGAL containing ^{18}O

28 What is the number of the formed glucose molecules from 12 molecules of phosphoglyceraldehyde ?

ⓐ 2
ⓑ 3
ⓒ 4
ⓓ 6

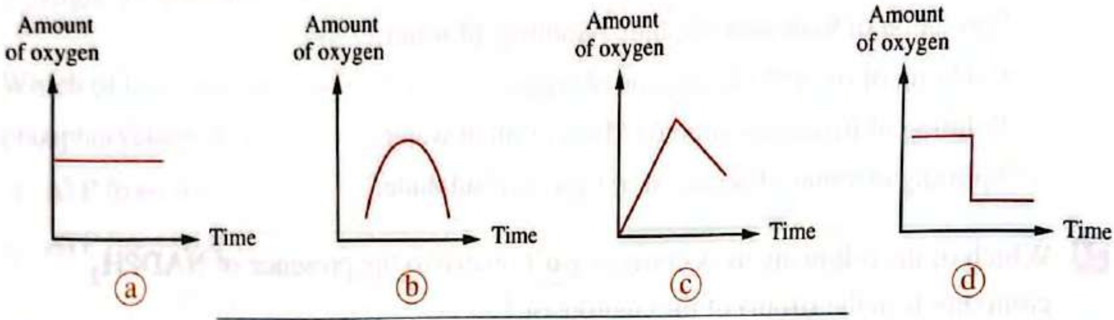
29 Which of the following compounds **doesn't** agree with the dark reactions' products ?

ⓐ Formation of ADP
ⓑ Formation of glucose.
ⓒ Formation of oxygen.
ⓓ Formation of NADP

30 Which of the following compounds **isn't** produced, when exposing the *Chlorella* alga to light for two seconds only ?

ⓐ $NADPH_2$ ⓑ ATP ⓒ PGAL ⓓ $C_6H_{12}O_6$

31 If we supposed that a green plant is exposed to a continuous light for 24 hours, which of the following graphs expresses the amount of oxygen that is produced by the plant ?



32 The photosynthesis process takes place through two successive stages of biochemical reactions, which of the following belongs to the second stage ?

ⓐ The storage of light energy. ⓑ CO_2 fixation.

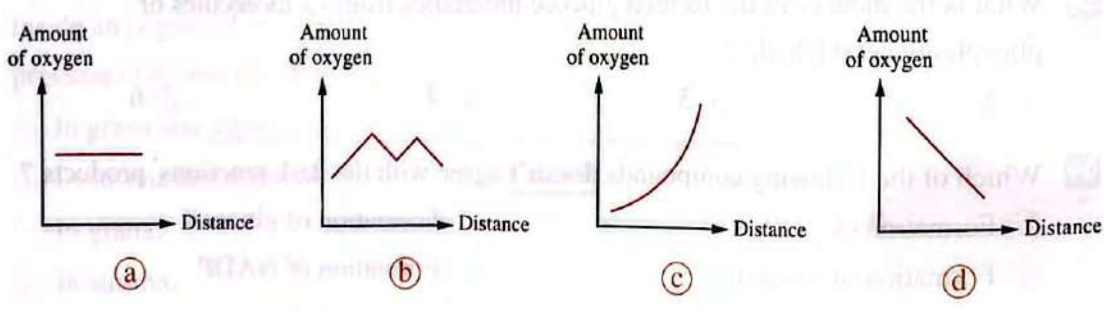
ⓒ Releasing of O_2 gas.

ⓓ The occurrence of photosynthetic phosphorylation.

33 In the following table, which of the following choices summarizes the photosynthesis process ?

	The conversion of energy	Photosynthesis process product	The storage form
ⓐ	From chemical to light	Glucose	Starch
ⓑ	From chemical to light	Starch	Glucose
ⓒ	From light to chemical	Glucose	Starch
ⓓ	From light to chemical	Starch	Glucose

34 Which of the following graphs expresses the amount of the resulted oxygen, if the source of light is moved gradually and slowly away from the green plant within 24 hours of continuous exposure ?



35 What is the source of glucose that is present in the cell sap of the root hair ?

ⓐ Absorbed from the soil by active transport.

ⓑ Resulted from the catabolism.

ⓒ Resulted from the photosynthesis process.

ⓓ Resulted from the catabolism and photosynthesis processes.

36 From your study to the opposite diagram :

(1) → (2) → X —(4)→ / —(5)→ Y → Glucose ; (7) ; (6) ; (3) ; NADP

(1) To which does no. (1) refer ?

ⓐ ATP ⓑ H_2O

ⓒ O_2 ⓓ CO_2

(2) To which does no. (3) refer ?

ⓐ $NADPH_2$ ⓑ ADP ⓒ O_2 ⓓ Electrons.

(3) Which of the following expresses no. (4) ?

ⓐ $NADPH_2$ ⓑ ADP ⓒ CO_2 ⓓ Electrons.

(4) To which does each of (X) and (Y) refer respectively ?

ⓐ Grana / Stroma. ⓑ Stroma / Grana.

ⓒ Cytoplasm / Grana. ⓓ Stroma / Cytoplasm.

37 * Where do the reduction reactions inside the chloroplast occur ?

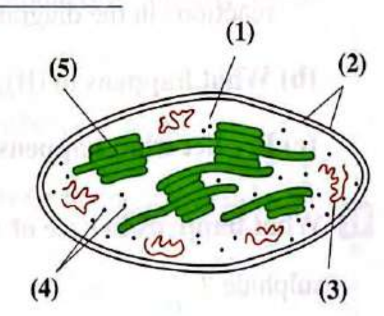
ⓐ In grana. ⓑ In stroma.

ⓒ In the double membrane. ⓓ In grana and stroma together.

Second Miscellaneous Questions

1 **Give reason for :** the stem of *Corchorus olitorius* "mulukhiyah" plant has the ability to perform photosynthesis process.

2 **In the opposite figure :**



(a) Determine the types of the main pigments that are present in structure no. (5).

(b) Explain how the processes happening in structure no. (1) are integrated with that happening in structure no. (5).

(c) Mention the number and name of the structure that :

1. Is present also in the cell nucleus.
2. Consists of colourless protein substance.
3. May disappear under certain conditions.

3 **What happens in case of :** the absence of grana from the chloroplasts in a plant ?

4 **What is the relation between :** the molecular structure of chlorophyll and the efficiency of photosynthesis process ?

5 **What happens in case of :** the absence of phloem tissue from the plant leaf ?

6 "Oxygen is always resulted from the photosynthesis process in the autotrophic organisms". **How far is this statement correct ? With explanation.**

7 "All types of bacteria are autotrophic organisms".
How far is this statement correct ? With explanation.

8 "Scientists used some isotopes in illustrating the mechanism of photosynthesis process".
How far is this statement correct ? With explanation.

9 "Dark reactions in plant don't need co-factors".
How far is this statement correct ? With explanation.

10 **The opposite diagram illustrates a part of important reactions that are occurred inside the green plant, in the light of this, answer the following :**

(a) **In which** part of the plant are the illustrated reactions in the diagram occurred ?

(b) **What happens** to (B), when (D) is absent ?

(c) **Predict what happens** if (E) is not formed.

11 **What happens in case of :** exposing sulphur bacteria to a decrease in hydrogen sulphide ?

12 "ATP molecules are formed directly from the light energy".
How far is this statement correct ? With explanation.

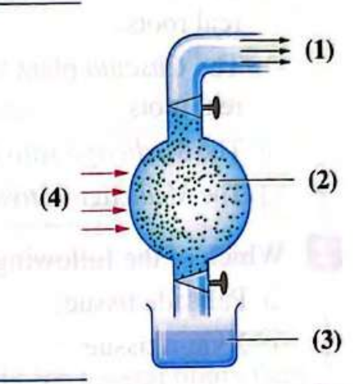
13 **What happens in case of :** decreasing the temperature of a plant below its suitable value "according to photosynthesis process" ?

14 **Explain :** the ability of plants to fix carbon dioxide gas in the dark, after being exposed to light.

15 "The high-energy organic compounds are formed in grana".

How far is this statement correct ? With explanation.

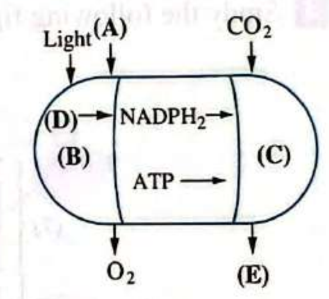
16 **The opposite figure illustrates an experiment that shows the nature of dark reactions in an alga :**



(a) **Determine** the mistake in the opposite experiment. **With explanation.**

(b) **What happens in case of :** the absence of factor no. (4) ?

17 **The opposite diagram illustrates a part of the plant where the photosynthesis process occurs :**



(a) **Where** do the illustrated reactions in the opposite diagram occur ?

(b) **Determine** the type of reaction that occurs in each of (B) and (C).

(c) **What** is the limiting factor for the rate of reactions in each of (B) and (C) ?

(d) **Deduce** the names of (A), (D) and (E) substances.

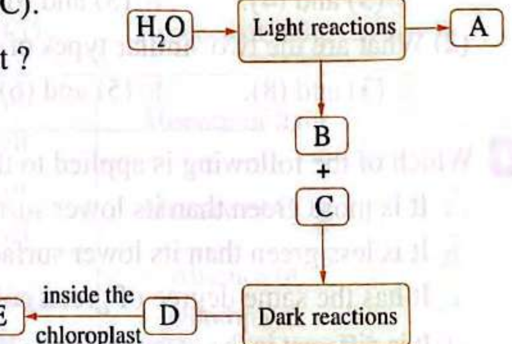
18 **Explain :** the organic compounds that are formed from the products of photosynthesis process are varied.

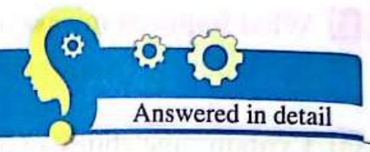
19 **The following diagram illustrates some steps of photosynthesis in plant :**

(a) **Deduce** the names of substances from (A) : (C).

(b) **How** is substance (D) formed inside the plant ?

(c) **Suggest** the site of (E) inside the plant leaf. **Explain your answer.**





Questions that measure **high levels of thinking**

Choose the correct answer :

1 If you know that the *Medicago sativa* plant is the host of the *Cuscuta* plant. So, which of the following can be concluded ?

ⓐ The *Medicago sativa* plant is devoid of chlorophyll and the *Cuscuta* plant contains real roots.

ⓑ The *Cuscuta* plant is devoid of chlorophyll and the *Medicago sativa* plant contains real roots.

ⓒ The *Medicago sativa* plant contains chlorophyll and the *Cuscuta* plant contains real roots.

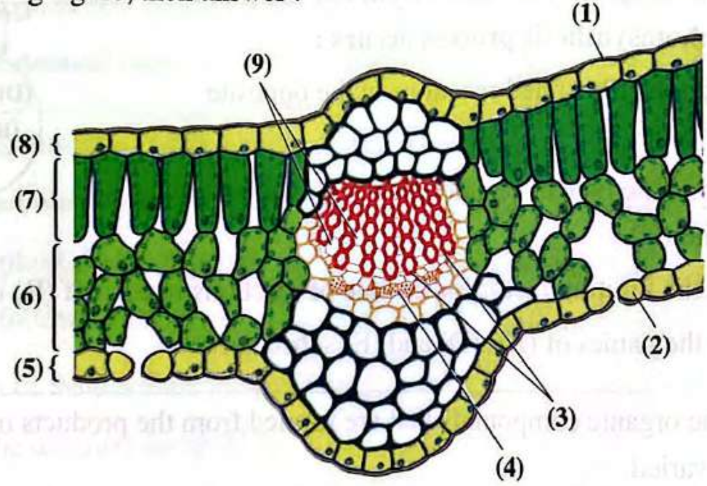
ⓓ The *Medicago sativa* plant is devoid of chlorophyll and the *Cuscuta* plant is devoid of roots.

2 Which of the following contains the highest percentage of starch granules ?

ⓐ Palisade tissue. ⓑ Spongy tissue.

ⓒ Xylem tissue. ⓓ Phloem tissue.

3 Study the following figure, then answer :



(1) Which of the following alternatives represents two different types of living and non-living cells which share in the formation of a compound tissue ?

ⓐ (3) and (4). ⓑ (5) and (6). ⓒ (3) and (9). ⓓ (7) and (8).

(2) What are the two similar types of cells which share in performing one function ?

ⓐ (3) and (8). ⓑ (5) and (6). ⓒ (6) and (7). ⓓ (7) and (8).

4 Which of the following is applied to the upper surface of the plant leaf ?

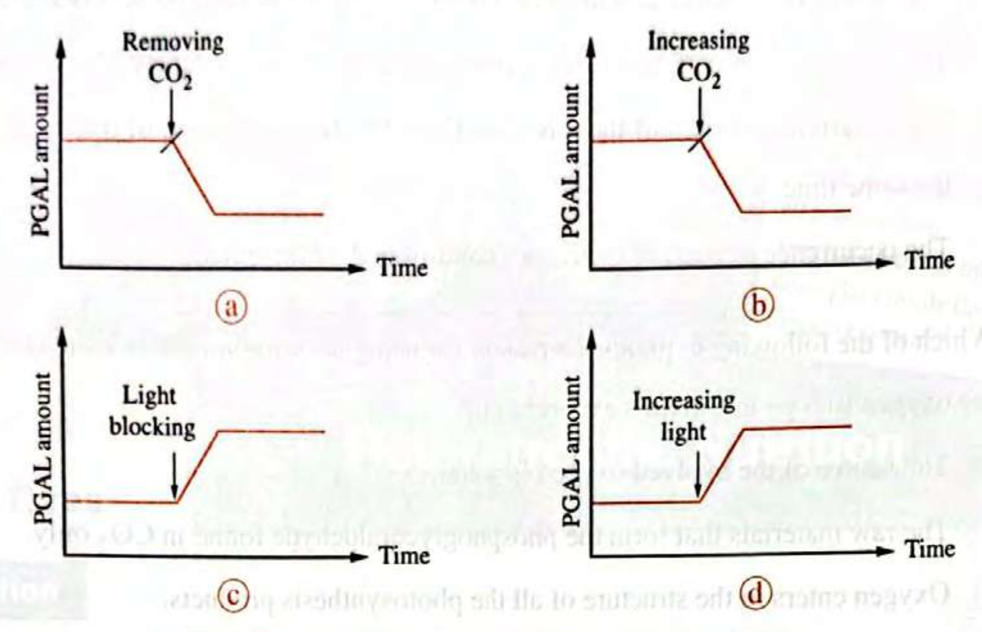
ⓐ It is more green than its lower surface.

ⓑ It is less green than its lower surface.

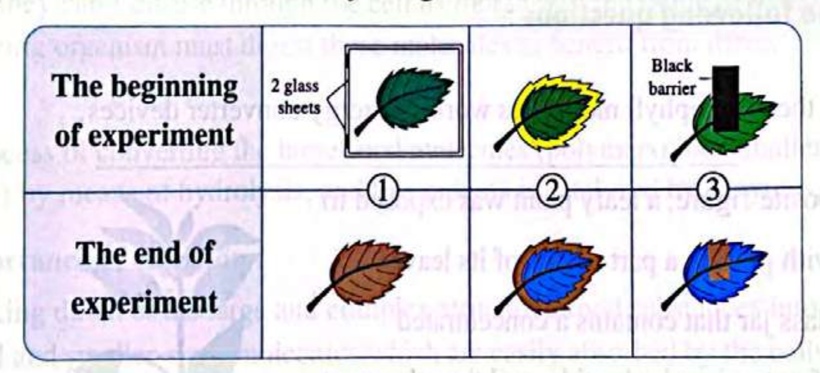
ⓒ It has the same degree of green colour of its lower surface.

ⓓ It is different in the green colour degree from its lower surface regarding to the light intensity.

5 Which of the following graphs represents the change that occurs in the amount of one of the affecting factors on the produced substances from the reactions that occur in the stroma ?



6 The following table shows the exposure of 3 plant leaves to light for several hours then detecting the starch in each of them by using iodine solution :



Which choice in the following table illustrates the reason for unchanging the colour of iodine solution in these leaves as shown at the end of the experiment ?

	(1)	(2)	(3)
ⓐ	Absence of chlorophyll	Absence of CO_2	Absence of light
ⓑ	Absence of CO_2	Absence of chlorophyll	Absence of light
ⓒ	Absence of light	Absence of chlorophyll	Absence of CO_2
ⓓ	Absence of CO_2	Absence of light	Absence of chlorophyll

7 Which of the following statements is correct about light and dark reactions ?

ⓐ The occurrence of light reactions is conditioned by the occurrence of dark reactions.

ⓑ The occurrence of dark reactions is conditioned by the occurrence of light reactions.

ⓒ The occurrence of each of them is conditioned by the occurrence of the other at the same time.

ⓓ The occurrence of each of them isn't conditioned by the other.

---

8 Which of the following explains the reason for using the carbon isotope instead of using the oxygen isotope in Calvin's experiment ?

ⓐ The source of the evolved oxygen is water.

ⓑ The raw materials that form the phosphoglyceraldehyde found in CO_2 only.

ⓒ Oxygen enters in the structure of all the photosynthesis products.

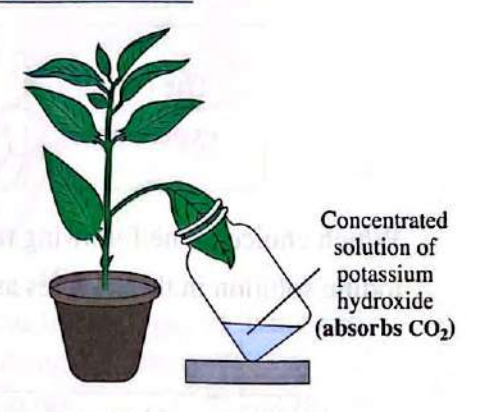
ⓓ The carbon isotope is easily detected than that of oxygen.

Answer the following questions :

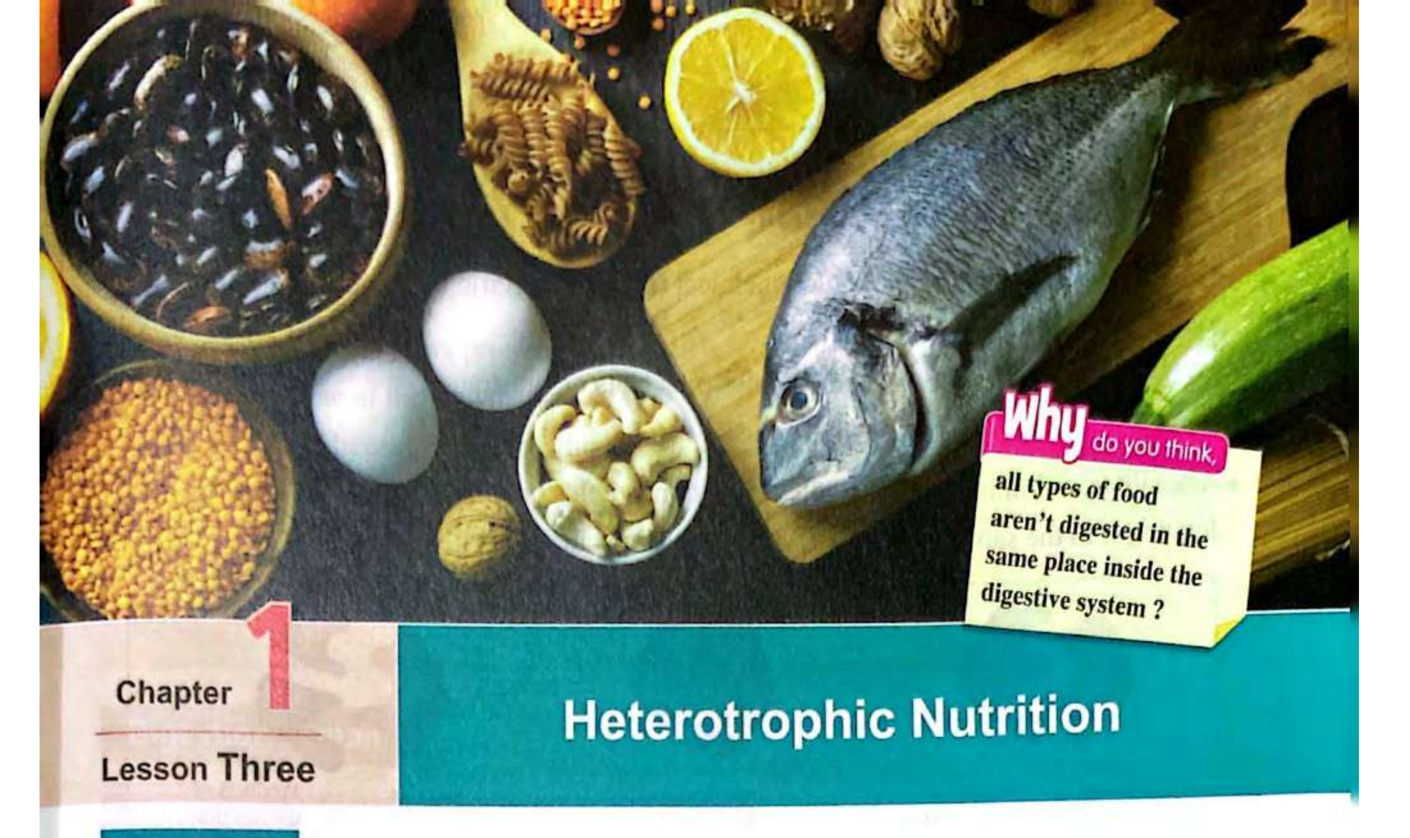
9 **Explain :** the chlorophyll molecules work as energy converter devices.

---

10 In the opposite figure, a leafy plant was exposed to sunlight with putting a part of one of its leaves inside a glass jar that contains a concentrated solution of potassium hydroxide, and the other part was exposed to light, and after several hours, the formation of starch was detected by using iodine solution on the two parts of the leaf.



What do you expect to happen ? Explain your answer.



Chapter 1

Lesson Three

Heterotrophic Nutrition

Digestion



- The heterotrophic living organism (consumer) obtains its food in the form of ready-made organic materials which are usually large and complex molecules, therefore they can't diffuse through the cell membranes of the living organism. So, the living organism must digest these molecules to benefit from them.

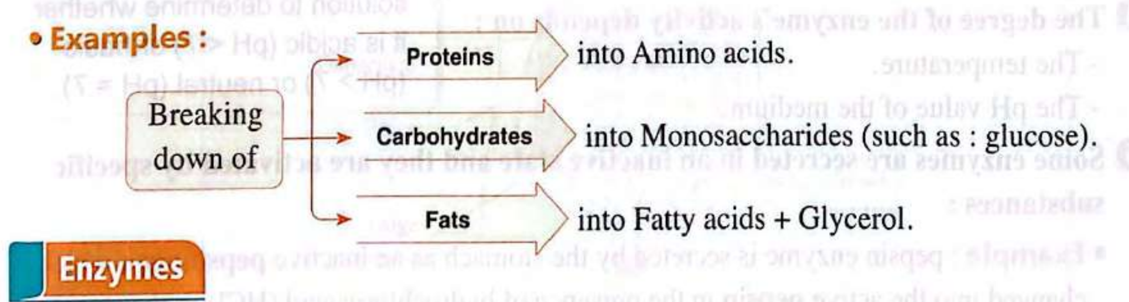
Digestion

It is the process of converting the large food molecules (polymers) into smaller ones (monomers) by means of hydrolysis, and this process is catalyzed by enzymes.

- **The importance of digestion :**

The breaking down of the large and complex-structured food substances into simpler structured and smaller-sized molecules which are easily absorbed by the cells (by diffusion or active transport), where the cells use them as a source of energy or to build new tissues and continue the growth.

- **Examples :**



Enzymes

Enzyme

It is a protein substance which has the properties of catalysts, as it has the ability to activate a particular chemical reaction.

Mechanism of the enzyme action

- Each enzyme activates a particular chemical reaction (specific activation), **and this reaction depends on :**
  - The structure of the reacting molecules (reactants or substrates).
  - The nature (shape) of enzyme.
- After the reaction is completed, the resulted molecules break away from the enzyme, leaving it in the same form as it was before the reaction.

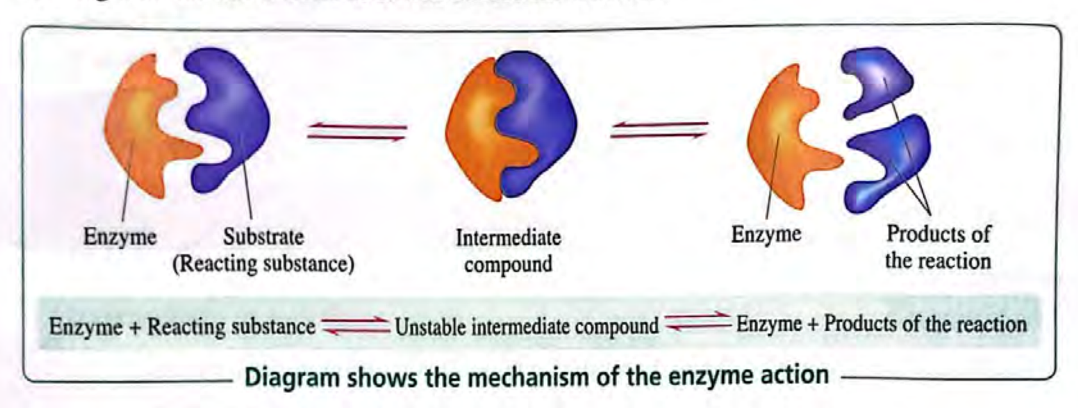
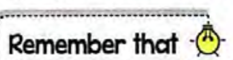


Diagram shows the mechanism of the enzyme action

Characteristics of enzymes

1. **They are specific :** as each enzyme can accelerate only one type of chemical reactions, depending on the structure of the reactant molecule and the nature (shape) of enzyme.
2. **Enzymes don't affect the products of the reaction :** as they work as catalysts which only accelerate the rate of the reaction, until it reaches the equilibrium state.
3. **Some enzymes have a reversible effect :** As the enzyme that catalyzes the decomposition of a complex molecule into two simpler ones, can also recombine these two small molecules again to give rise to the same complex molecule once more.
4. **The degree of the enzyme's activity depends on :**
   - The temperature.
   - The pH value of the medium.

Remember that



The pH value :
It is the measurement that determines the concentration of hydrogen ions (H^+) in the solution to determine whether it is acidic (pH < 7) or basic (pH > 7) or neutral (pH = 7).

5. **Some enzymes are secreted in an inactive state and they are activated by specific substances :**
   - **Example :** pepsin enzyme is secreted by the stomach as an inactive **pepsinogen** which is changed into the active **pepsin** in the presence of hydrochloric acid (HCl) in the stomach.

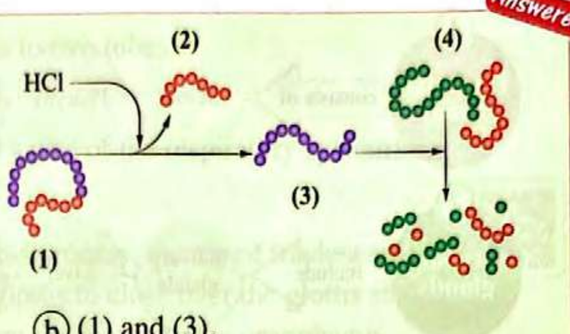
Pepsinogen (Inactive) $\xrightarrow{\text{HCl acid}}$ Pepsin (Active)

1 Test yourself

Answered

Choose the correct answer :

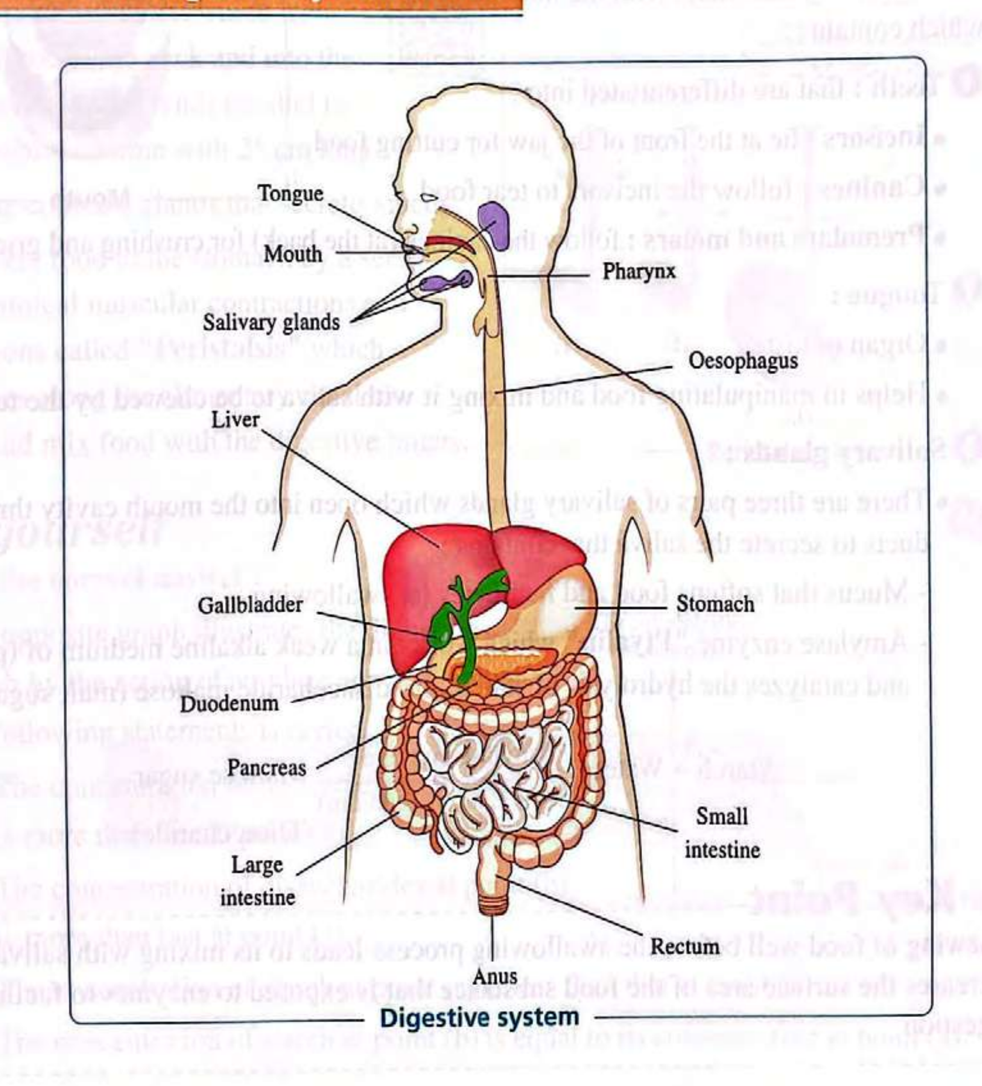
The opposite figure shows protein substances in one of the enzymatic reactions in the digestive system, which of them represent enzymes ?



(a) (1) and (2).
(b) (1) and (3).
(c) (2) and (3).
(d) (3) and (4).

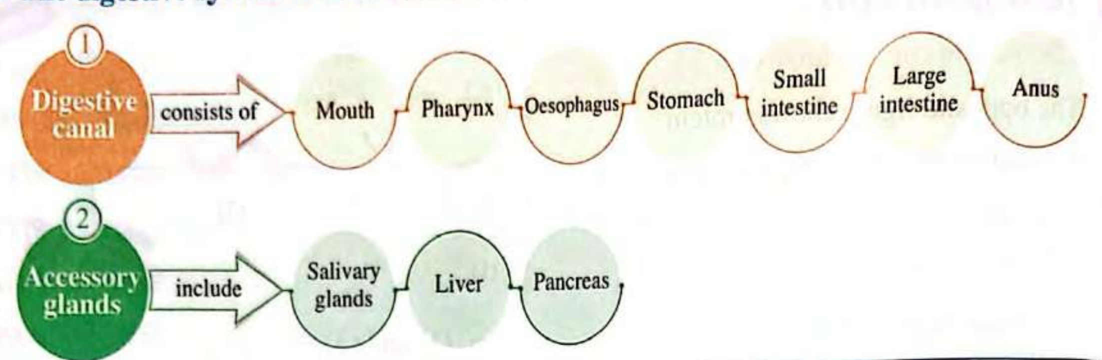
Digestion in man

Structure of the digestive system in man



Digestive system

- **The digestive system in man consists of :**



Stages of digestion

1 Buccal digestion

Mouth

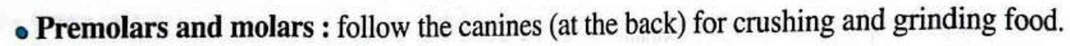
- The digestive canal starts with the mouth opening which contains :

1 Teeth : that are differentiated into :

- **Incisors :** lie at the front of the jaw for cutting food.
- **Canines :** follow the incisors to tear food.

Incisors
Premolars
Molars
Canines
Tongue

Mouth



- **Premolars and molars :** follow the canines (at the back) for crushing and grinding food.



2 Tongue :

- Organ of taste.
- Helps in manipulating food and mixing it with saliva to be chewed by the teeth.

3 Salivary glands :

- There are three pairs of salivary glands which open into the mouth cavity through ducts to secrete the saliva that contains :
  - Mucus that softens food and facilitates its swallowing.
  - Amylase enzyme "**Ptyalin**" which works in a weak alkaline medium of (pH = 7.4) and catalyzes the hydrolysis of starch into disaccharide maltose (malt sugar).

$$\text{Starch + Water} \xrightarrow[\text{(Weak alkaline medium)}]{\text{Amylase enzyme}} \text{Maltose sugar (Disaccharide)}$$

Key Point

Chewing of food well before the swallowing process leads to its mixing with saliva which increases the surface area of the food substance that is exposed to enzymes to facilitate its digestion.

Pharynx

- It is a cavity at the back of mouth which leads to two tubes :
  - The first is **oesophagus**.
  - The second is **trachea** (which is considered a part of the respiratory system).

Swallowing process



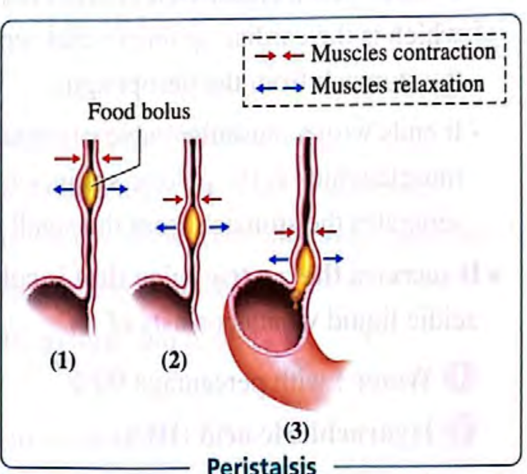
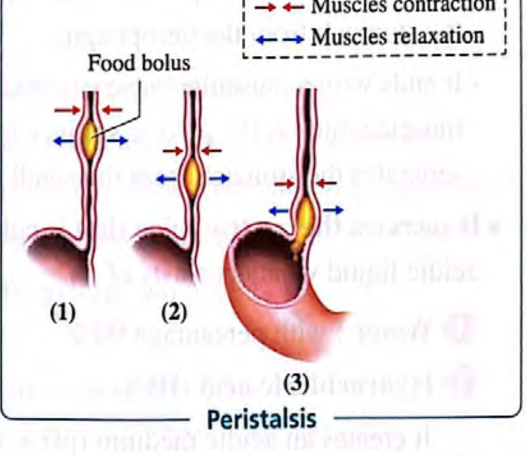
It is an organized reflex action, where during this process, the top of trachea and larynx are elevated together in front of the epiglottis to close over the glottis (the entrance to air passage). So, food is pushed from the mouth to the oesophagus.

Do you know...?

- Reflex action is an involuntary fast response for a certain sensory stimulus that is occurred without the intervention of will or consciousness.

Oesophagus

- It follows the pharynx, where it passes through the neck and into the chest cavity, and extends parallel to the vertebral column with 25 cm long.
- Its lining contains glands that secrete mucus.
- It transfers food to the stomach by a series of rhythmical muscular contractions and relaxations called "**Peristalsis**" which continues along the alimentary canal to churn and mix food with the digestive juices.

Peristalsis



Test yourself

Answered

Choose the correct answer :

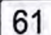
1. The opposite graph illustrates the digestion of starch by the action of amylase enzyme. Which of the following statements is correct ?

The concentration of substrate

(a)

(b)

Time



ⓐ The concentration of disaccharides at point (a) is more than that at point (b).

ⓑ The concentration of disaccharides at point (b) is more than that at point (a).

ⓒ The concentration of starch at point (a) is less than that at point (b).

ⓓ The concentration of starch at point (b) is equal to its concentration at point (a).

2 On which of the following does the specificity of the amylase enzyme depend in its work ?

ⓐ The structure of each of starch and maltose sugar.

ⓑ The shape of amylase enzyme and temperature.

ⓒ The structure of maltose sugar and the pH value.

ⓓ The structure of starch and the shape of amylase enzyme.

2 Gastric digestion (Digestion in stomach)

Stomach

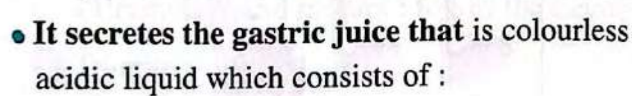


- **It is a dilated muscular sac :**
  - It starts with a constricted circular muscle which is the cardiac sphincter that separates the stomach from the oesophagus.
  - It ends with a muscular valve of circular smooth muscle which is the pyloric sphincter that separates the stomach from the small intestine.

Oesophagus
Cardiac sphincter
Pyloric sphincter
Stomach muscles
Duodenum

Stomach

- **It secretes the gastric juice that** is colourless acidic liquid which consists of :



1 Water : with percentage 90%

2 Hydrochloric acid (HCl) :

It creates an acidic medium (pH = 1.5 : 2.5) inside the stomach, **which leads to :**

- Stopping the action of ptyalin enzyme.
- Killing the harmful bacteria that may enter with food.

3 Pepsin enzyme : is secreted in an inactive form called **"pepsinogen"** and it is activated by the action of HCl acid to digest proteins.

$$\underset{\text{(Inactive)}}{\text{Pepsinogen}} \xrightarrow{\text{HCl acid}} \underset{\text{(Active)}}{\text{Pepsin}}$$

- **Proteins digestion :**

The active pepsin enzyme catalyzes the hydrolysis of protein by breaking certain peptide bonds in the long chains of protein to convert them into smaller fragments (chains) of polypeptides.

$$\text{Protein + Water} \xrightarrow[\text{HCl acid}]{\text{Pepsin}} \text{Polypeptides}$$

Notes

1. Proteins are the only food substances which are affected by the gastric juice.
2. The gastric juice doesn't affect the cells which line the stomach, **this is due to :**
   - The presence of **pepsinogen** in an inactive form which is activated only after being secreted from the cells of stomach, and when it is mixed with HCl acid in the cavity of stomach.
   - The presence of **heavy mucous secretions** of the inner wall of stomach which protect it against the effect of digestive enzymes.



Test yourself



Choose the correct answer :

1 What happens during the passage of food through oesophagus ?

ⓐ The action of ptyalin enzyme stops.

ⓑ The action of ptyalin enzyme continues.

ⓒ The action of pepsin enzyme starts.

ⓓ The action of ptyalin enzyme stops and that of pepsin enzyme starts.

2 From the most common symptoms of Gastro-oesophageal reflux is the occurrence of an inflammation in the lower part of its lining, which of the following may cause that ?

ⓐ A disturbance in the muscle that controls the cardiac sphincter.

ⓑ A disturbance in the muscle that controls the pyloric sphincter.

ⓒ A disturbance in the two muscles.

ⓓ A disturbance in the secretion of HCl acid in stomach.

3 Intestinal digestion



Small intestine

- It follows the stomach and consists of duodenum and ileum.
- It is about 8 meters long.
- It is about 3.5 cm in diameter at its beginning to reach 1.25 cm at its end.
- It folds over itself, the coils and loops of small intestine are connected together by the **mesentery** membrane.



Key Point

The presence of the small intestine is restricted on a limited area from the abdominal cavity, due to the presence of many folds in it.

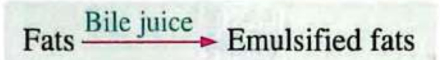
- **The digestive juices inside the small intestine :** a group of juices are secreted and work on food digestion, **which are as follows :**

A Bile juice

- It is secreted from the liver on food during its passage in the duodenum, and it is devoid of the digestive enzymes.
- It converts the fats into emulsified fats, (i.e. dividing the large masses of fats into small fat globules) to facilitate and accelerate the enzymatic action on fats that don't dissolve in water.



The bile juice is stored in the gallbladder till secreted in the duodenum.



Fats —Bile juice→ Emulsified fats

Integration with Chemistry



The breaking down of substrate into small parts causes the increase in the substrate surface area that exposed to the reaction which consequently accelerates its rate.

B Pancreatic juice

- It is secreted from the pancreas on food in the duodenum.
- Pancreatic juice contains :

1. **Sodium bicarbonate :**

   It neutralizes HCl acid and makes the medium alkaline (pH = 8).

2. **Pancreatic amylase enzyme :**

   It catalyzes the hydrolysis of glycogen and starch into disaccharide (maltose).

   Starch or glycogen + Water —Pancreatic amylase (Alkaline medium)→ Maltose (Malt sugar)

3. **Trypsinogen enzyme :**

   It is inactive, but it changes into the active form which is "**trypsin**" in the duodenum by the action of enterokinase enzyme that is secreted by the inner wall of the small intestine, where trypsin enzyme catalyzes the hydrolysis of protein into polypeptides.

   Trypsinogen **(Inactive)** —Enterokinase→ Trypsin **(Active)**

   Protein + Water —Trypsin (Alkaline medium)→ Polypeptides

4 Lipase enzyme :

It catalyzes the hydrolysis of the emulsified fats into fatty acids and glycerol.

$$\text{Emulsified fats + Water} \xrightarrow[\text{(Alkaline medium)}]{\text{Lipase}} \text{Fatty acids + Glycerol}$$

C Intestinal juice



- It is secreted by special cells in the wall of the small intestine and contains a mixture of enzymes that complete the action of the previous enzymes and end the digestion of all food constituents, **which are as follows :**

1 Peptidases enzymes :

They are several types, where each one of them is specialized in breaking the peptide bonds that are present between certain types of amino acids in the polypeptide chain to give various amino acids at the end.

$$\text{Polypeptide chain} \xrightarrow[\text{(Alkaline medium)}]{\text{Peptidases enzymes}} \text{Amino acids}$$

2 A group of enzymes which hydrolyze disaccharides into monosaccharides, which are as follows :

- **Maltase enzyme :** hydrolyzes maltose (malt sugar) into two molecules of glucose (grape sugar).

$$\text{Maltose} \xrightarrow[\text{(Alkaline medium)}]{\text{Maltase enzyme}} \text{Two molecules of glucose}$$

- **Sucrase enzyme :** hydrolyzes sucrose (cane sugar) into glucose and fructose (fruit sugar).

$$\text{Sucrose} \xrightarrow[\text{(Alkaline medium)}]{\text{Sucrase enzyme}} \text{Glucose + Fructose}$$

- **Lactase enzyme :** hydrolyzes lactose (milk sugar) into glucose and galactose.

$$\text{Lactose} \xrightarrow[\text{(Alkaline medium)}]{\text{Lactase enzyme}} \text{Glucose + Galactose}$$

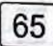
3 Enterokinase enzyme :

It is not from the digestive enzymes, but it acts only as a co-enzyme to activate the trypsinogen enzyme.



Key Points

- The enzyme which hydrolyzes disaccharides into identical monosaccharides is maltase enzyme.
- The digestion of disaccharides as sucrose and lactose sugars start and end in the small intestine.
- Sugars are found in blood in a monosaccharide form.



Test yourself



Choose the correct answer :

1 As a result of an injury in the gallbladder of a person, it had been removed surgically, which of the following processes can be affected by this ?
(a) The removal of amino groups of proteins. (b) The digestion of carbohydrates.
(c) The breaking down of peptide bonds of proteins.
(d) The digestion of fats.

2 A person ate a type of food and it was not affected by the digestive enzymes, until it reached the duodenum, what do you expect this type of food to be ?
(a) Plant protein. (b) Animal protein. (c) Carbohydrates. (d) Fats.

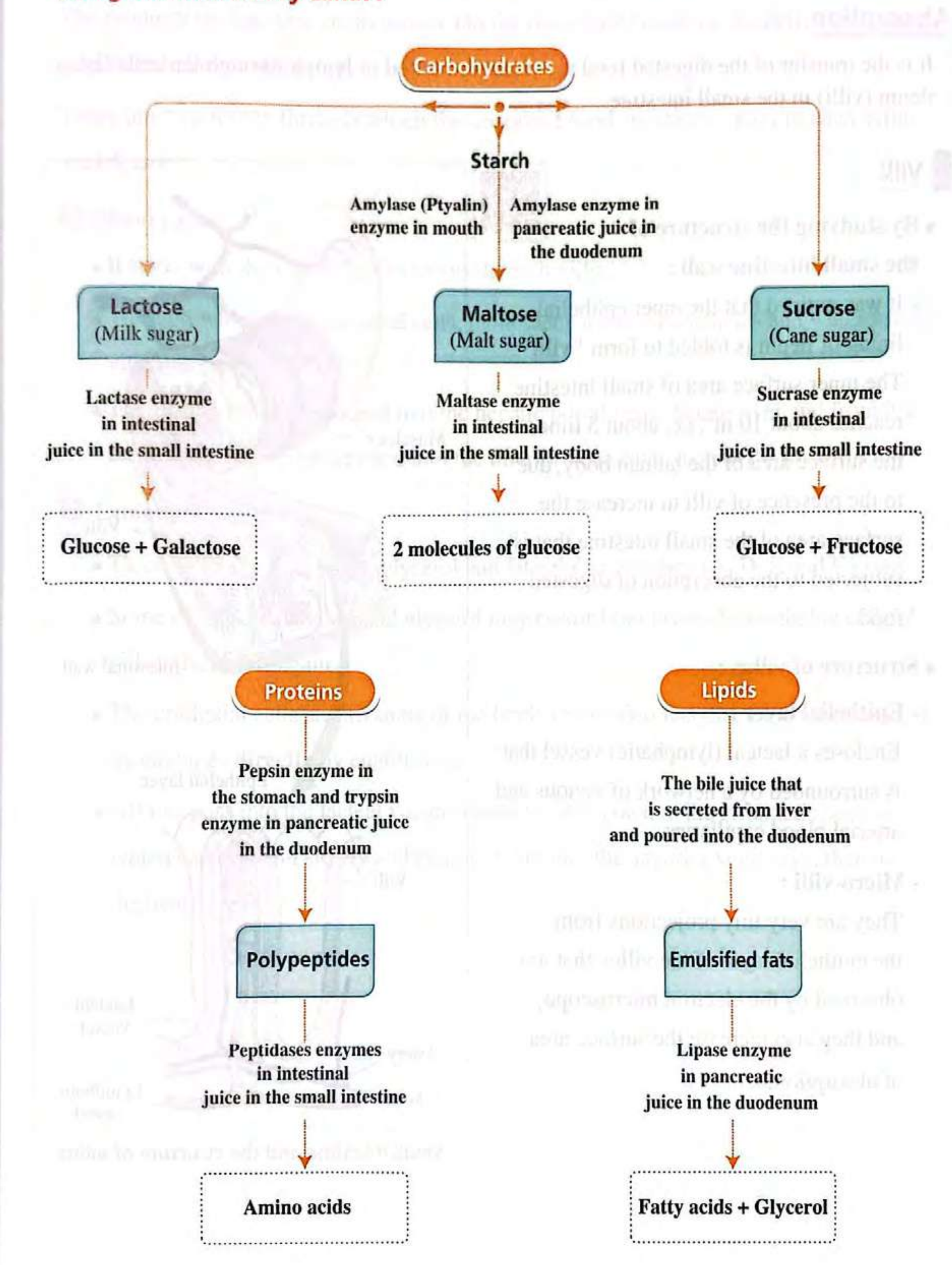
3 What is the enzyme that is secreted from the small intestine and completes the action of another enzyme secreted from the stomach ?
(a) Lipase. (b) Pancreatic amylase. (c) Trypsin. (d) Peptidase.

4 Which of the following enzymes produces symmetrical and simpler molecules through its action ?
(a) Sucrase. (b) Lactase. (c) Lipase. (d) Amylase.

A summary for the digestive juices that are secreted on food in the alimentary canal :

The juice	The secretory organ	Site of action	Contents
Saliva :	Salivary glands.	Mouth	• Mucus. • Amylase (Ptyalin) enzyme.
Gastric juice :	Inner stomach wall.	Stomach cavity.	• Water. • HCl acid. • Pepsinogen enzyme.
Bile :	Liver	Duodenum	• Contains bile that is devoid of digestive enzymes.
Pancreatic juice :	Pancreas	Duodenum	• Sodium bicarbonate. • Pancreatic amylase enzyme. • Trypsinogen enzyme. • Lipase enzyme.
Intestinal juice :	Specialized cells in the small intestine wall.	Ileum	• Peptidases enzymes. • Maltase enzyme. • Sucrase enzyme. • Lactase enzyme. • Enterokinase enzyme.

◎ **A summary for the stages of carbohydrates, proteins and lipids digestion along the alimentary canal :**



Absorption of digested food

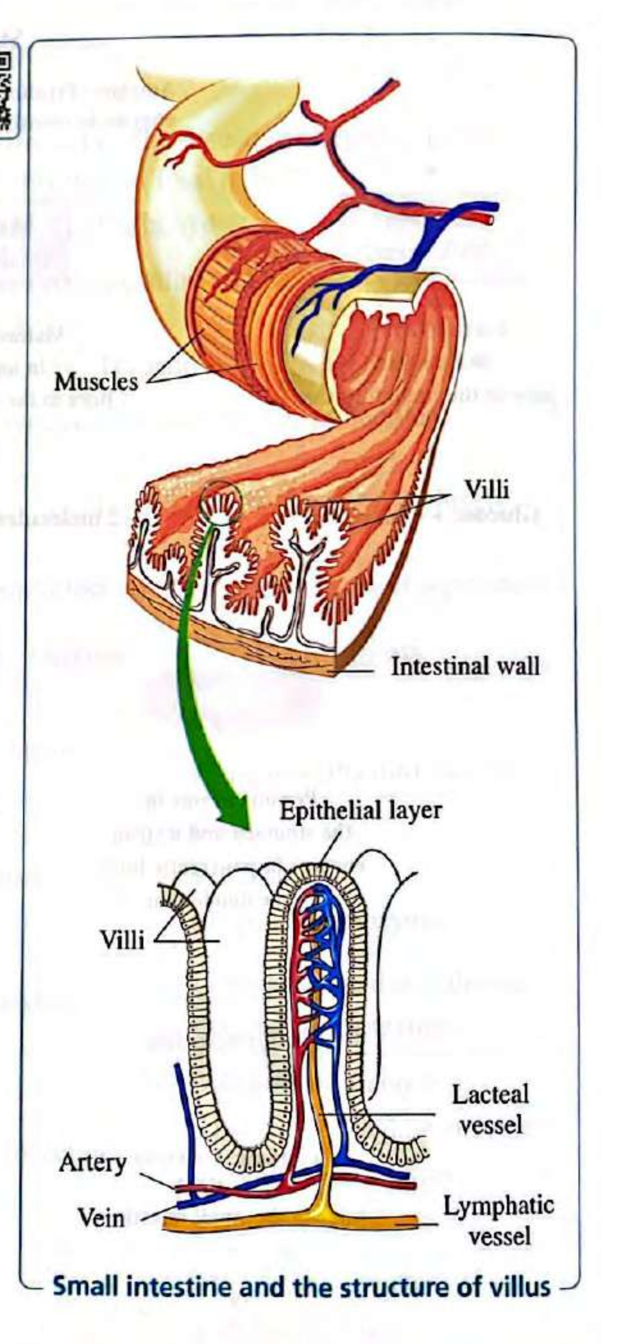
Absorption

It is the transfer of the digested food substances to blood or lymph through the cells lining ileum (villi) in the small intestine.

Villi

- **By studying the structure of the small intestine wall :**
  - It was noticed that the inner epithelial lining of ileum is folded to form "**villi**".
  - The inner surface area of small intestine reaches about 10 m^2, i.e. about 5 times the surface area of the human body, due to the presence of villi to increase the surface area of the small intestine that is subjected to the absorption of digested food.

- **Structure of villus :**
  - **Epithelial layer :**
    Encloses a lacteal (lymphatic) vessel that is surrounded by a network of venous and arterial blood capillaries.
  - **Micro-villi :**
    They are very tiny projections from the epithelial layer of the villus that are observed by the electron microscope, and they also increase the surface area of absorption.



Small intestine and the structure of villus

Mechanism of absorption of the digested food by the villi

- The products of digestion are transferred to the blood and lymph by the **active transport and membranous diffusion**.
- There are two routes through which the absorbed food substances pass in each villus, **which are :**

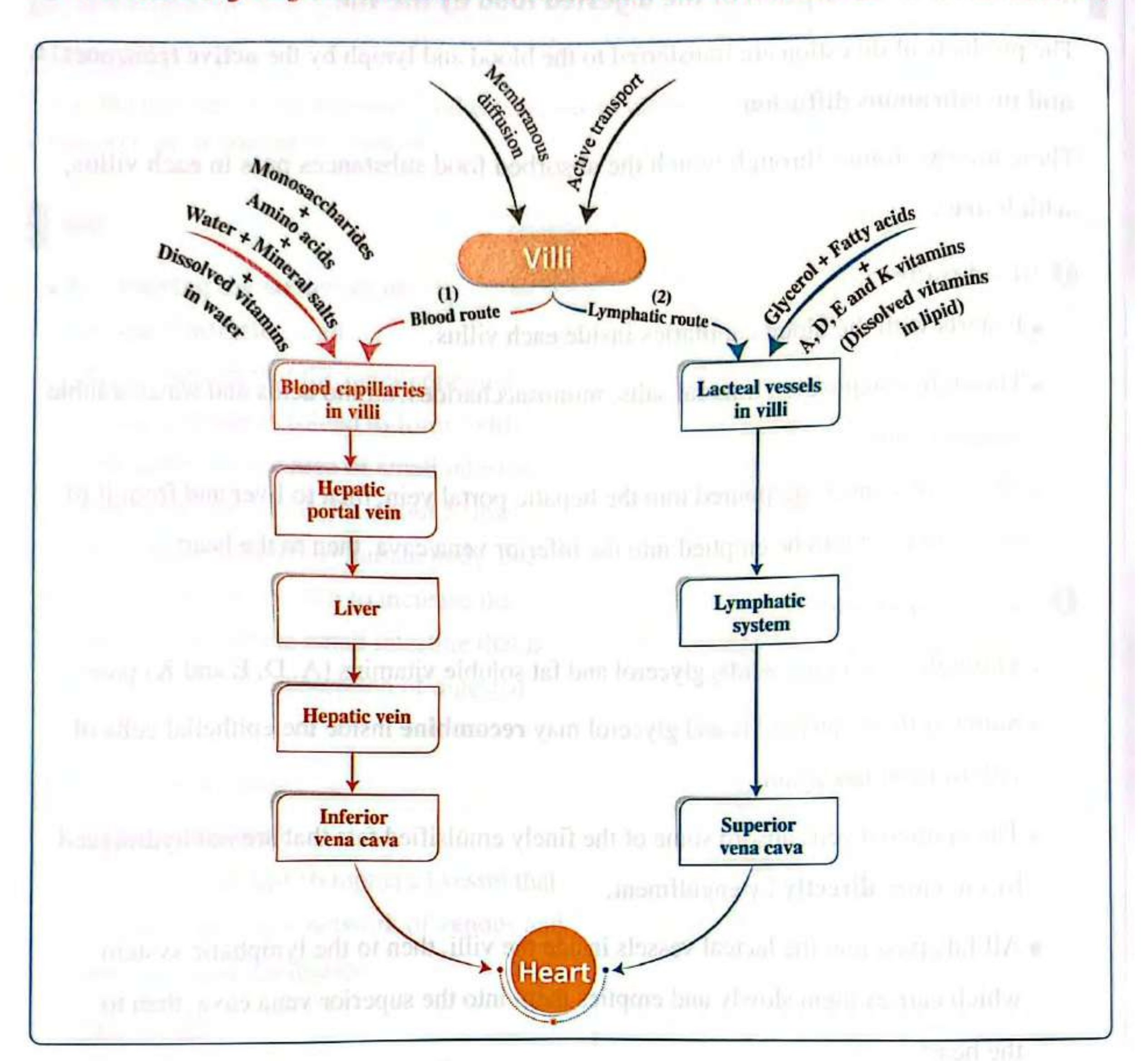
① Blood route :

- It starts with the blood capillaries inside each villus.
- Through which water, mineral salts, monosaccharides, amino acids and water soluble vitamins pass.
- These substances are poured into the hepatic portal vein, then to liver and from it to the hepatic vein to be emptied into the inferior vena cava, then to the heart.

② Lymphatic route :

- Through which fatty acids, glycerol and fat soluble vitamins (A, D, E and K) pass.
- Some of these fatty acids and glycerol may **recombine** inside the epithelial cells of villi to form fats again.
- The epithelial cells absorb some of the finely emulsified fats that are not hydrolyzed by enzymes **directly** by engulfment.
- All fats pass into the lacteal vessels inside the villi, then to the lymphatic system which carries them slowly and empties them into the superior vena cava, then to the heart.

◎ **The following diagram illustrates the routes of the absorbed food substances in villus :**



Key Points

- From the water soluble vitamins are vitamins (B) complex and vitamin (C).
- The inferior vena cava carries completely digested food substances as carbohydrates and proteins, while the superior vena cava carries some of the undigested substances as fats through the lacteal vessels.



Test yourself



Choose the correct answer :

1. Which of the following statements is applied to the inner surface of the small intestine ?
   - (a) Thin and rich in blood capillaries.
   - (b) Thick and poor in blood capillaries.
   - (c) Rich in villi and poor in blood capillaries.
   - (d) Poor in villi and rich in blood capillaries.

2. Which of the following food substances **doesn't/don't** reach the blood directly ?
   - (a) Fatty acids.
   - (b) Amino acids.
   - (c) Water soluble vitamins.
   - (d) Glucose.

Metabolism

Metabolism :

It is the process by which the body utilizes the digested food substances that had been absorbed.

- **Metabolism includes two opposite processes, which are :**

1 Anabolism

- A process by which the simple and small-sized food particles are **changed into** complex compounds that enter in the structure of the body **where :**
  - Monosaccharides are changed into starch that is stored in the form of glycogen in liver and muscles.
  - The fatty acids and glycerol are changed into fats and stored mainly beneath the skin.
  - The amino acids are changed into different types of proteins in the body.

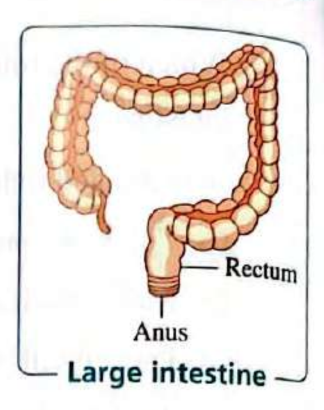
2 Catabolism

- A process by which the absorbed food substances (especially glucose) are **oxidized** to produce the energy required for performing the vital activities of the body.

Large intestine and defecation



- The undigested food wastes rush into the large intestine.
- The lining of large intestine contains many convolutions to help in the absorption of water and some salts through it.
- Food wastes become semi-solid and have a bad odour inside the large intestine, due to the presence of some types of bacteria in it.
- The large intestine secretes mucus to facilitate the passage of food wastes to outside.



Large intestine

- Waste remains are expelled out in the form of faeces through anus, as a result of the strong muscular contractions of the rectum that accompanied by the relaxation of the two muscles of the anal sphincter which are situated on both sides of anus.

Key Point

- Number of sphincter muscles that are included in the digestive system inside the human body is four, **which are :**
  - Ring sphincter muscle (involuntary) that controls the cardiac sphincter.
  - Ring sphincter muscle (involuntary) that controls the pyloric sphincter.
  - Two sphincter muscles (voluntary) on both sides of the anus.

6 *Test yourself*

Answered

Mucus has an important role along the alimentary canal. **Deduce** this in 4 different regions in the human digestive system.

....

....

....

....

Chapter 1

Questions on Lesson Three

Heterotrophic Nutrition



The questions signed by ✳ are answered in detail. ● Understand ○ Apply ● Analyze



First Multiple Choice Questions

Mechanism of the enzyme action and buccal digestion

1 The digestion process of food aims to its change into substances which can be ....

ⓐ swallowed. ⓑ excreted. ⓒ defecated. ⓓ absorbed.

2 From the opposite diagram, what happens to the rate of production of (D), if enzyme no. (1) is absent ?

A —Enzyme (1)→ B —Enzyme (2)→ C —Enzyme (3)→ D

ⓐ It stops. ⓑ It increases.

ⓒ It decreases. ⓓ It isn't affected.

3 From the two following reactions, what can be deduced regarding the two enzymes (1) and (2) ?

$CO_2 + H_2O \xrightarrow{(1)} H_2CO_3$

$H_2CO_3 \xrightarrow{(2)} CO_2 + H_2O$

ⓐ Enzymes (1) and (2) are the same.

ⓑ Enzyme (2) slows down the production of CO_2

ⓒ Both enzymes can build-up macro-molecules only.

ⓓ Both enzymes break down the macro-molecules only.

4 On eating a piece of bread, which of the following enzymes will start its action first ?

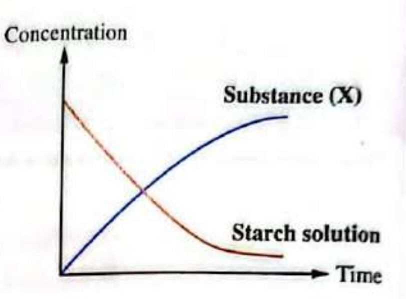
ⓐ Trypsin. ⓑ Peptidase. ⓒ Amylase. ⓓ Lipase.

5 In which part of the human alimentary canal does the enzyme work efficiently, if the optimum pH for this enzyme = 7.5 ?

ⓐ Mouth. ⓑ Small intestine.

ⓒ Stomach. ⓓ Large intestine.

6 The opposite graph illustrates the production of substance (X) when the enzyme works on a starch solution. What does substance (X) represent ?

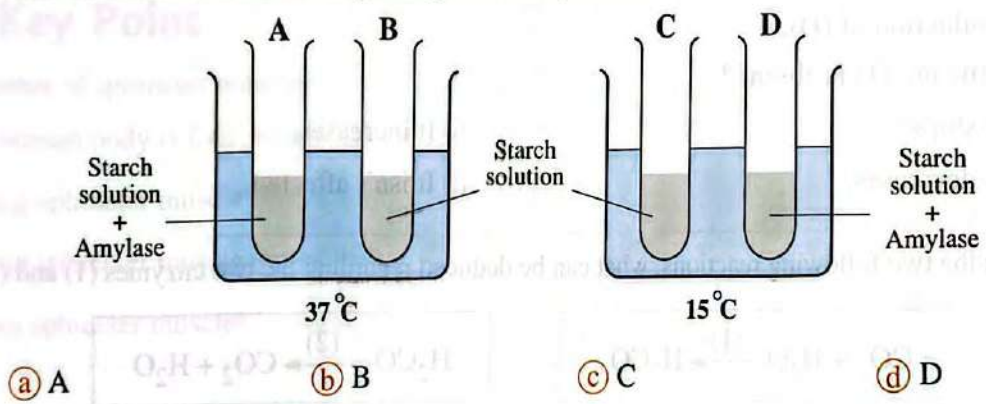


ⓐ Lactose. ⓑ Sucrose.
ⓒ Glucose. ⓓ Maltose.

7 When having a breakfast meal that consists of eggs, honey and some pastries, what do you expect to be digested first in the mouth ?

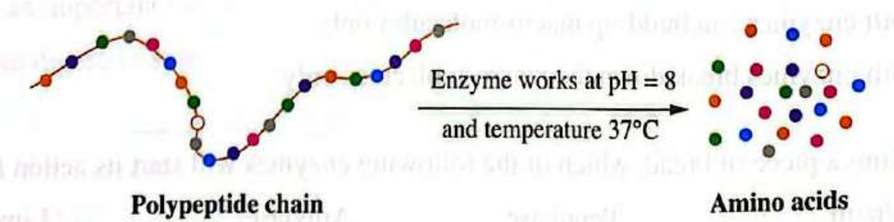
ⓐ Eggs. ⓑ Honey.
ⓒ Pastries. ⓓ Honey and pastries together.

8 Which tube in the two following figures contains the highest content of maltose after 20 minutes from the beginning of the experiment ?



ⓐ A ⓑ B ⓒ C ⓓ D

9 The following figure shows the effect of an enzyme that works in the human digestive canal, which of the following decreases the production rate of amino acids ?



ⓐ The removal of the produced amino acids when formed.
ⓑ Increasing the amount of polypeptide chains.
ⓒ The stability of the temperature at 37°C.
ⓓ Decreasing the pH value to 2

10 In case you eat all the following foods, on which one of them can the body depend to form the required enzymes to complete the vital processes ?

ⓐ Rocca. ⓑ Corn. ⓒ Eggs. ⓓ Orange.

11 ✻ Which of the following figures illustrates a starch molecule, after being digested in the mouth ?

ⓐ ⓑ ⓒ ⓓ

Gastric and intestinal digestion

12 Why does the action of the salivary amylase enzyme stop in the stomach ?

ⓐ Due to the decrease in the enzyme amount.
ⓑ Due to changing all carbohydrates into maltose sugar.
ⓒ Due to the difference in pH
ⓓ Due to the difference in temperature.

13 Which of the following its digestion may be affected, if the liver is severely damaged ?

ⓐ Carbohydrates. ⓑ Fats.
ⓒ Proteins. ⓓ Disaccharides.

14 From which of the following juices are the digestive enzymes completely absent ?

ⓐ Pancreatic. ⓑ Gastric. ⓒ Bile. ⓓ Intestinal.

15 Where does the digestion of oils that are used in preparing meals start ?

ⓐ In mouth. ⓑ In oesophagus.
ⓒ In stomach. ⓓ In small intestine.

16 Which of the following food substances its digestion starts and ends in the small intestine ?

ⓐ Cheese. ⓑ A piece of meat. ⓒ Peanut butter. ⓓ Rice.

17 Which of the following enzymes the bile juice plays an important role in accelerating its activity ?

ⓐ Lipase. ⓑ Maltase. ⓒ Amylase. ⓓ Trypsin.

18 Which of the following organs its infection affects the digestion of each of fats, proteins and carbohydrates together ?

ⓐ Pancreas. ⓑ Stomach. ⓒ Large intestine. ⓓ Liver.

19 Which of the following enzymes digest a different type of food substance from the rest of the enzymes ?

ⓐ Maltase. ⓑ Lipase. ⓒ Sucrase. ⓓ Lactase.

20 Which of the following enzymes **doesn't** complete the action of other enzymes or juices by breaking down their products into simpler molecules ?

ⓐ Lipase. ⓑ Enterokinase. ⓒ Peptidase. ⓓ Maltase.

21 Which of the following enzymes **doesn't** produce simpler and symmetrical molecules through its action ?

ⓐ Ptyalin. ⓑ Maltase. ⓒ Pancreatic amylase. ⓓ Lactase.

22 Which of the following enzymes have a role in the complete hydrolysis of glycogen ?

ⓐ Amylase and lipase. ⓑ Amylase and sucrase.

ⓒ Amylase and lactase. ⓓ Amylase and maltase.

23 Which of the following **doesn't** contain digestive enzymes for carbohydrates ?

ⓐ Saliva. ⓑ Pancreatic juice.

ⓒ Gastric juice. ⓓ Intestinal juice.

24 Which of the following **isn't** correct about trypsin and pepsin enzymes ?

ⓐ Trypsin enzyme works in an alkaline medium, while pepsin enzyme works in an acidic medium.

ⓑ Trypsin and pepsin enzymes act on the same substrate.

ⓒ Trypsin enzyme works in the small intestine, while pepsin enzyme works in the stomach.

ⓓ Trypsin enzyme is secreted in an active form, while pepsin enzyme is secreted in an inactive form.

25 Where does the protein digestion start and end respectively ?

ⓐ Mouth / Stomach. ⓑ Stomach / Ileum.

ⓒ Oesophagus / Stomach. ⓓ Duodenum / Ileum.

26 Which of the following contains glands that secrete mucus only ?

ⓐ Pancreas. ⓑ Stomach.

ⓒ Oesophagus. ⓓ Small intestine.

27 Which of the following food substances aren't affected by the action of the digestive enzymes ?

ⓐ Proteins and minerals. ⓑ Fats and vitamins.
ⓒ Fats and proteins. ⓓ Minerals and vitamins.

28 Which of the following has a role in the digestion process without secreting digestive enzymes ?

ⓐ Liver. ⓑ Pancreas. ⓒ Small intestine. ⓓ Stomach.

29 The opposite graph shows the relation among 3 enzymes that share in digesting a food substance, what do enzymes (A) and (B) represent respectively ?

ⓐ Pepsin / Pepsinogen.
ⓑ Pepsinogen / Pepsin.
ⓒ Trypsinogen / Trypsin.
ⓓ Trypsin / Trypsinogen.

30 The opposite graph shows the results of an experiment through which the enzyme action was measured at different pH values, in which part of the digestive canal does this enzyme work ?

ⓐ Mouth. ⓑ Oesophagus.
ⓒ Small intestine. ⓓ Stomach.

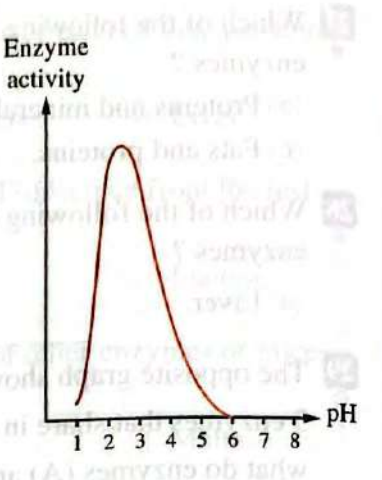
31 Where are fats completely digested ?

ⓐ In mouth. ⓑ In stomach.
ⓒ In oesophagus. ⓓ In small intestine.

32 The opposite figure shows an experiment carried out in the room temperature, which of the following substances can be detected in water after 45 minutes ?

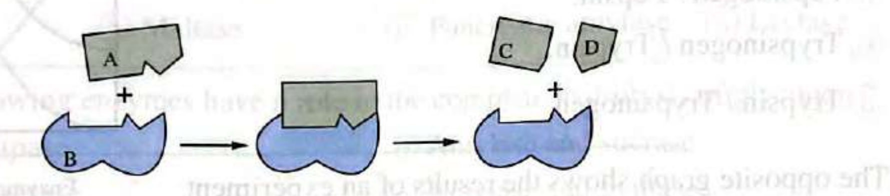
ⓐ Amino acids and simple sugars.
ⓑ Protein and amino acids.
ⓒ Protein and monosaccharides.
ⓓ Starch and monosaccharides.

33 The opposite graph illustrates the effect of pH on the rate of a digestive enzyme activity, which of the following choices represents the substrate and the product ?



	Substrate	Product
(a)	Polypeptides	Amino acids
(b)	Proteins	Polypeptides
(c)	Carbohydrates	Maltose
(d)	Fats	Fatty acids

34 The following diagram illustrates the action of a digestive enzyme :



If (D) is a fructose molecule. What do (A), (B) and (C) represent ?

	A	B	C
(a)	Glucose molecule	Sucrose molecule	Sucrase enzyme
(b)	Sucrase enzyme	Glucose molecule	Sucrose molecule
(c)	Sucrose molecule	Sucrase enzyme	Glucose molecule
(d)	Glucose molecule	Sucrase enzyme	Sucrose molecule

35 * Which of the following pairs are **not** similar in their action ?

(a) Pepsin and trypsin.
(b) Ptyalin and pancreatic amylase.
(c) HCl acid and enterokinase enzyme.
(d) Bile juice and maltase.

36 * Which of the following enzymes **doesn't** digest the same type of carbohydrates ?

(a) Maltase. (b) Amylase. (c) Sucrase. (d) Lactase.

37 * Which of the following enzymes participate in the digestion of milk ?

(a) Pepsin – Trypsin – Peptidases – Maltase.
(b) Amylase – Maltase – Pepsin – Lactase.
(c) Pepsin – Trypsin – Peptidases – Lactase.
(d) Peptidases – Trypsin – Maltase – Lactase.

Absorption and metabolism

38 How many voluntary sphincter muscles are present in the digestive system of human ?
ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

39 Which of the following food substances takes a different route in its absorption ?
ⓐ Egg white. ⓑ Butter. ⓒ Honey. ⓓ Bread.

40 If the lacteal vessels are blocked inside the villi, which of the following nutrients will **not** enter in the blood circulation with a normal rate ?
ⓐ Amino acids. ⓑ Glucose. ⓒ Fats. ⓓ Fructose.

41 Which of the following enzymes **won't** produce substances that are absorbed by the body ?
ⓐ Maltase. ⓑ Lactase. ⓒ Enterokinase. ⓓ Sucrase.

42 Why is the absorption process of some products of digestion by villi called active transport process ?
ⓐ Because of the conversion of large food molecules into small-sized molecules.
ⓑ Because it is a hydrolysis process that depends on enzymes.
ⓒ Because it is required to an amount of energy to be absorbed.
ⓓ Because of its transfer to the bloodstream.

43 What is the name of the process by which the absorbed food becomes a part of the body ?
ⓐ Anabolism. ⓑ Catabolism. ⓒ Digestion. ⓓ Absorption.

44 Which of the following is considered a result of the occurrence of digestion process of a food bolus ?
ⓐ The impermeability of its simple molecules through the cell membranes.
ⓑ The non-occurrence of the absorption process in the small intestine.
ⓒ Its presence in the form of wastes in the large intestine.
ⓓ The body benefits from it as a source of energy.

45 ✻ Which of the following blood vessels vitamin (B) **doesn't** pass through it, to reach the heart ?
ⓐ Hepatic portal vein. ⓑ Hepatic vein.
ⓒ Inferior vena cava. ⓓ Superior vena cava.

46 ✻ The action of each of .... is required for the absorption of (A, D and K) vitamins.
ⓐ bile and amylase ⓑ bile and peptidases
ⓒ bile and pancreatic juice ⓓ trypsin and enterokinase

Second Miscellaneous Questions

1 **What happens in case of :** the absence of enzymes from the digestive system ?

2 **What happens in case of :** increasing the temperature of the medium where the enzyme is present ?

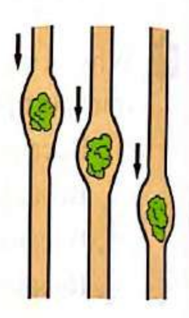
3 **Explain :** some enzymes work in two opposite directions.

4 **What happens in case of :** placing a piece of bread in the mouth and chewing it for three minutes ?

5 **Give reason for :** food passes easily in the digestive canal.

6 **What happens in case of :** the removal of epiglottis from the pharynx ?

7 **The opposite figure represents a part of the human digestive system :**



(a) **Where** does this movement take place in the digestive canal ? **And what** is its name ?

(b) **Illustrate** the mechanism of this movement.

(c) **What** is the function of this movement in the process of food digestion ?

8 **Give reason for :** human doesn't suffer from ulcers in the oesophagus, when eating dry food.

9 **Explain :** hydrochloric acid plays an important role in the digestion process in stomach.

10 **What happens if :** a person took a high dosage of antacid drug ?

11 **What happens if :** the gastric juice contains sodium bicarbonate ?

12 **From the opposite figure :**

(a) **How** does structure no. (3) participate in the digestion process ?

(b) **What is the functional suitability of** structure no. (1) ?

(c) **Show how** to control the opening and closing of structures no. (2) and no. (4).

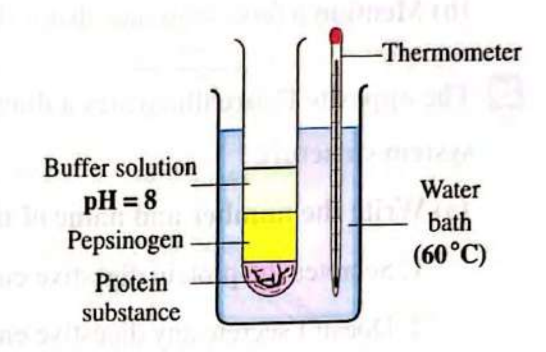
13 **Explain :** when a person eats a meal that consists of rice, meat and vegetables, meat is the only food substance which is affected by the gastric juice.

14 **What happens if :** pepsin enzyme is formed in an active form inside the stomach cells ?

15 **Give reason for :** starch is not digested inside the stomach, in spite of mixing food with ptyalin enzyme.

16 **From the opposite figure :**

Correct the mistakes in this figure to make the enzyme work efficiently and digest the substrate (protein substance) that is present in the tube "**without drawing**".



17 **Give reason for :** the occurrence of stomach ulcer in some cases.

18 **Explain :** the stomach doesn't digest itself.

19 **Give reason for :** bile juice is not a digestive juice.

20 **Explain :** the activity of liver improves the efficiency of the digestion process.

21 **What happens in case of :** the absence of bile juice from the human body ?

22 **Give reason for :** pepsin enzyme digests protein in the stomach, while its action stops in the small intestine.

23 **What happens in case of :** the non-secretion of sodium bicarbonate in the pancreatic juice ?

24 **Give reason for :** enterokinase enzyme plays an indirect role in the proteins digestion.

25 **What is the similarity between :** enterokinase enzyme and HCl acid ?

26 "Eating fast food stimulates the activity of peptidases enzymes to digest them".
How far is this statement correct ? With explanation.

27 "The small intestine contains a mixture of food substances, such as polypeptides and several enzymes, such as trypsin".
Deduce the reason for why trypsin doesn't affect the polypeptides, although it digests proteins.

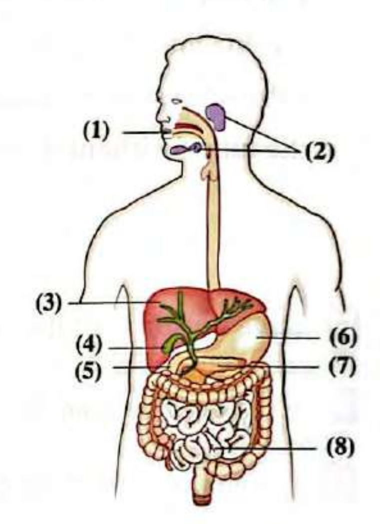
28 **"The degree of hydrogen ion concentration (pH) plays an important role in the stages of food digestion" :**

(a) • **Illustrate** the role of pH in mouth, stomach and duodenum.

• **Follow up** the (pH) role in the whole digestive canal.

(b) **Mention** a food substance that is digested at two different pH values.

29 **The opposite figure illustrates a diagram for the digestive system structure :**



(a) **Write the number and name of the organ that :**

1. Secretes the protein digestive enzymes.
2. Doesn't secrete any digestive enzymes.
3. Secretes amylase enzyme.
4. The digestion of carbohydrates occurs inside it.

(b) **What** is the function of the liquid that is produced by part no. (7) and secreted in part no. (5) ?

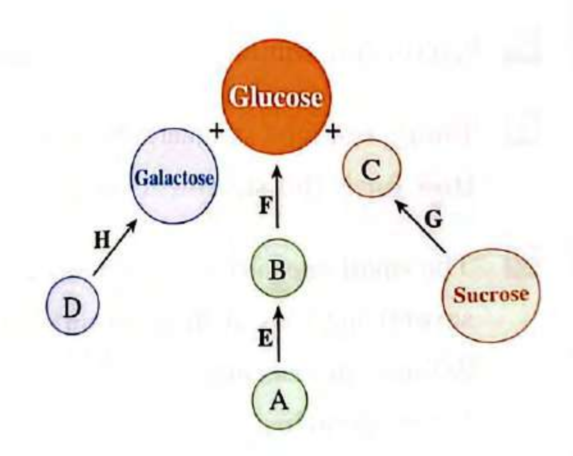
30 **"The alimentary canal contains enzyme (X) that hydrolyzes molecule (A) into two similar molecules of monosaccharides" :**

(a) **What** is the name of each of enzyme (X) and molecule (A) ?

(b) **In which** part in the alimentary canal is enzyme (X) secreted ? **And in which part of it** molecule (A) is formed ?

31 **Explain :** the digestion in stomach is different from that in the small intestine.

32 **In the opposite diagram :**

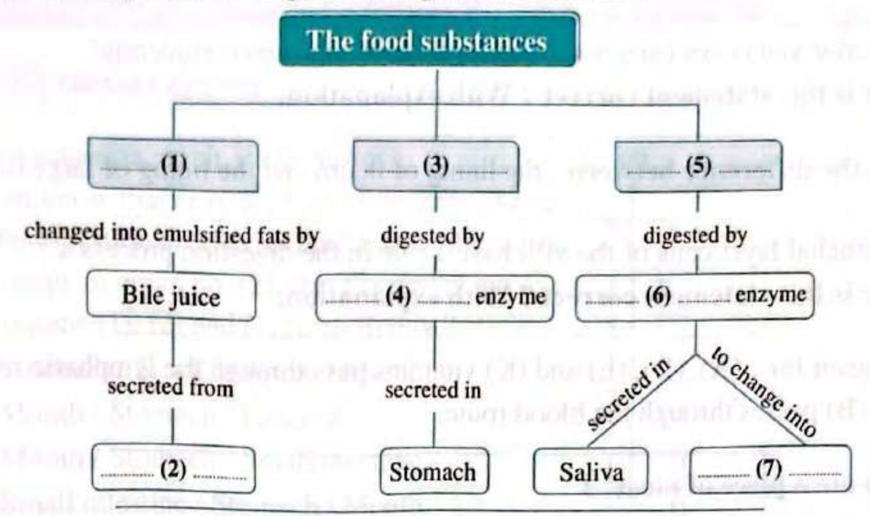


(a) **What** do the letters illustrated in this diagram represent ?

(b) **Deduce** what happens if (F) is replaced by (E). **Explain your answer.**

(c) **Determine** the sources of secretion of (E), (F), (G) and (H) in the digestive system.

33 **The following diagram shows a summary for the digestion process of food substances, complete the diagram using suitable words :**

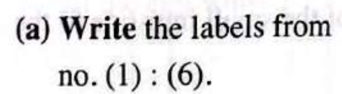


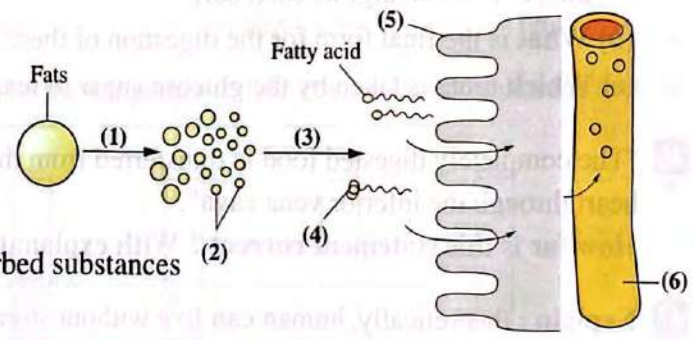
34 **Explain :** the presence of carbohydrates in the form of monosaccharides in blood.

35 "The activity of enzymes depends on the type of food that the human eats".
How far is this statement correct ? With explanation.

36 **Give reason for :** the presence of engulfing cells in the epithelial layer of villi.

37 **The opposite figure illustrates the digestion of a part of fats through the digestive system :**

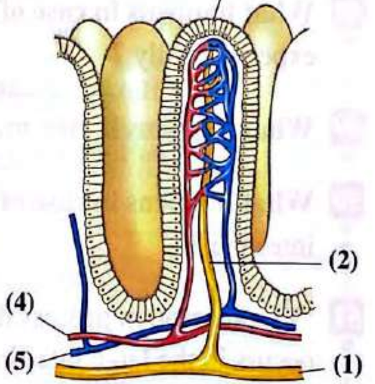




(a) Write the labels from no. (1) : (6).

(b) Mention the path of the absorbed substances through structure no. (6).

38 **The following diagrammatic figure represents the structure of a villus :**



(a) Mention the names of the structures which transport the amino acids and fatty acids.

(b) Which of the two structures no. (4) or (5) contains a higher percentage of glucose ? **Explain your answer.**

(c) Mention the name of the structure which pours its contents in the superior vena cava.

(d) Illustrate the function of structure no. (3).

(e) Compare between : structure no. (1) and structure no. (5), "**according to :** the absorbed substances and their path".

39 **Explain :** the absorption process of some digestion products through the villi is known as an active transport process.

40 "The inferior vena cava carries substances that are digested completely".
How far is this statement correct ? With explanation.

41 **What is the difference between :** the lining of ileum and the lining of large intestine ?

42 "The epithelial layer cells of the villi have a role in the digestion process".
How far is this statement correct ? With explanation.

43 **Give reason for :** (A), (D), (E) and (K) vitamins pass through the lymphatic route, while vitamin (B) passes through the blood route.

44 **"A man ate a piece of meat" :**

(a) **How** does his digestive system digest this piece of meat ?

(b) **What** is the route that the products of the digestion process passed through to reach the liver ?

45 **"A meal consists of bean, oil and bread" :**

(a) **Determine** the first place for the digestion of each component of the meal and the juice which digests each part.

(b) **What** is the final form for the digestion of these components ?

(c) **Which** route is taken by the glucose sugar to reach the heart ?

46 "The completely digested food is transferred from the villi of the small intestine to the heart through the inferior vena cava".
How far is this statement correct ? With explanation.

47 **Explain :** theoretically, human can live without stomach, but he can't live without small intestine.

48 **What happens in case of :** the removal of ileum from the body of a mammalian animal experimentally ?

49 **What happens if :** the metabolism of the absorbed food in the liver is not occurred ?

50 **What happens in case of :** the absence of convolutions from the lining of large intestine ?

51 "The absorption process that occurs in the small intestine is different from that which occurs in the large intestine".
How far is this statement correct ? With explanation.

Questions that measure **high levels of thinking**



Choose the correct answer :

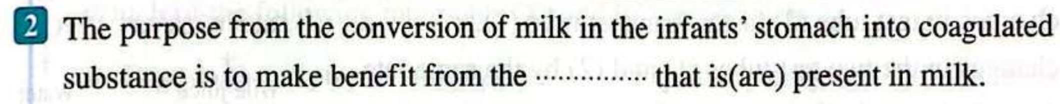
1 Study the opposite graph, then answer :

(1) If you know that enzyme (C) has an indirect role in the digestion process and the action of enzyme (A) stops in organ no. (2), therefore what are the organs (1), (2) and (3) respectively ?

ⓐ Stomach / Small intestine / Mouth.
ⓑ Mouth / Stomach / Pancreas.
ⓒ Mouth / Stomach / Small intestine.
ⓓ Small intestine / Stomach / Mouth.

(2) Which of the following activates enzyme (B) ?

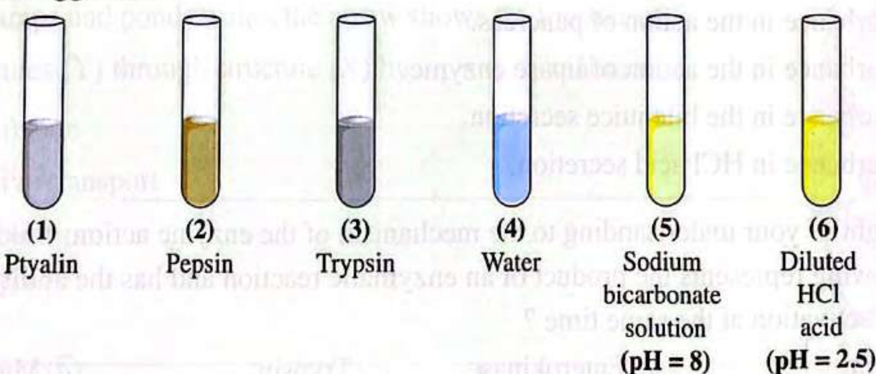
ⓐ HCl acid. ⓑ Sodium bicarbonate.
ⓒ Enterokinase enzyme. ⓓ Ptyalin enzyme.



2 The purpose from the conversion of milk in the infants' stomach into coagulated substance is to make benefit from the .... that is(are) present in milk.

ⓐ sugar ⓑ protein ⓒ mineral salts ⓓ fats

3 Which of the following tubes can be used together to form two different solutions that digest the egg white ?



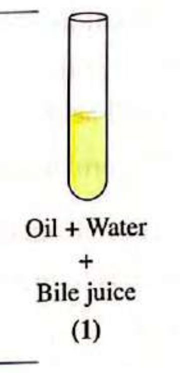
	The first solution	The second solution
ⓐ	(2) + (4)	(3) + (5)
ⓑ	(1) + (4) + (5)	(2) + (4) + (6)
ⓒ	(2) + (4) + (6)	(3) + (4) + (5)
ⓓ	(3) + (4) + (5)	(1) + (4) + (6)

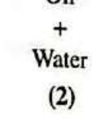
4 A sample was taken from the juice that is present inside the pancreatic duct, what is the digestive effect of this sample if drops of it are put on protein, fats and starch separately (in optimal conditions) ?

	Proteins	Fats	Starch
ⓐ	Digested by a normal rate	Digested by a lower rate than the normal rate	Not digested
ⓑ	Not digested	Digested by a lower rate than the normal rate	Digested by a normal rate
ⓒ	Digested by a lower rate than the normal rate	Digested by a normal rate	Not digested
ⓓ	Digested by a lower rate than the normal rate	Not digested	Digested by a lower rate than the normal rate

5 In the two opposite figures, the pH value in the two test tubes (1) and (2) is adjusted to be 8, after adding lipase enzyme to the two test tubes, what happens to the mixture shape ?

ⓐ It changes in test tube (1) faster than test tube (2).
ⓑ It changes in test tube (2) faster than test tube (1).
ⓒ It changes in the two test tubes (1) and (2) by the same rate.
ⓓ It doesn't change in the two test tubes.





6 Which of the following **doesn't** cause the presence of a high percentage of fats in the wastes of the digestive system ?

ⓐ Disturbance in the action of pancreas.
ⓑ Disturbance in the action of lipase enzyme.
ⓒ Disturbance in the bile juice secretion.
ⓓ Disturbance in HCl acid secretion.

7 In the light of your understanding to the mechanism of the enzyme action, which of the following represents the product of an enzymatic reaction and has the ability of specific activation at the same time ?

ⓐ Pepsin ⓑ Enterokinase. ⓒ Trypsin. ⓓ Maltase.



Test on Chapter 

Nutrition and Digestion in Living Organisms

Choose the correct answer (1 : 20) :

1 If we supposed that plant (X) obtains its food in the form of glucose, vitamin (B), water and salts. So, which of the following statements is correct according to this plant ?

ⓐ It is autotrophic plant which contains simple chlorophyll.

ⓑ It is autotrophic plant which contains chlorophyll (A) only.

ⓒ It is autotrophic plant which contains chlorophyll (B) only.

ⓓ It is heterotrophic plant which doesn't contain chlorophyll (A) or (B).

2 The following diagram represents a vital process that occurs inside the human body :

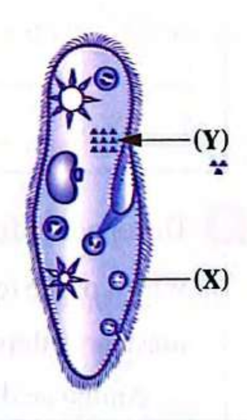
Polypeptides + H_2O —(X)→ △ + ○ + □ + ▭ (Y)

Which of the following represents (X) and (Y) respectively ?

ⓐ Peptidases enzymes / Polypeptides. ⓑ Peptidases enzymes / Amino acids.

ⓒ Trypsin enzyme / Amino acids. ⓓ Pepsin enzyme / Polypeptides.

3 The opposite figure illustrates a unicellular protozoan that lives in swamps and ponds water, the arrow shows the transfer of molecules (Y) through structure (X) by .... phenomenon.



ⓐ diffusion

ⓑ active transport

ⓒ imbibition

ⓓ osmosis

4 The green plants **can't** live in deep depths in oceans, this is because ....

ⓐ there is no suitable soil to fix the plants roots.

ⓑ the oxygen concentration is very high in deep depths.

ⓒ the light intensity is very low.

ⓓ the carbon dioxide concentration is very low.

5 What is the organ that secretes digestive enzymes for all types of food ?

ⓐ Stomach.
ⓑ Small intestine lining.
ⓒ Gallbladder.
ⓓ Pancreas.

6 The fungal infection causes a deficiency in the chlorophyll synthesis in the plant cells, which of the following happens as a result of this deficiency ?

ⓐ The non-formation of the co-enzymes.
ⓑ The non-formation of ATP in light reactions.
ⓒ No entry of CO_2 to the stroma.
ⓓ Deficiency in the formed amount of glucose from photosynthesis.

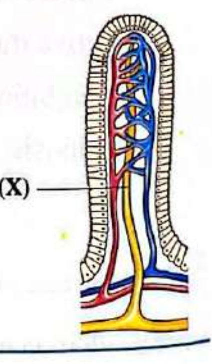
7 Which of the following **isn't** from the digestive enzymes in the human digestive system ?

ⓐ Enterokinase.
ⓑ Pepsin.
ⓒ Trypsin.
ⓓ Lipase.

8 Which choice in the following table illustrates the correct number of chloroplasts in three different cells in a green plant leaf ?

	Epidermal cell	Palisade tissue cell	Spongy tissue cell
ⓐ	0	6	17
ⓑ	0	17	6
ⓒ	6	17	0
ⓓ	17	0	6

9 The opposite figure represents a part of the human digestive canal :
Which of the following is from the absorbed substances through structure (X) ?



ⓐ Amino acids.
ⓑ Fats.
ⓒ Monosaccharides.
ⓓ Vitamin (B).

10 What is the organ that can be removed without affecting the human life ?

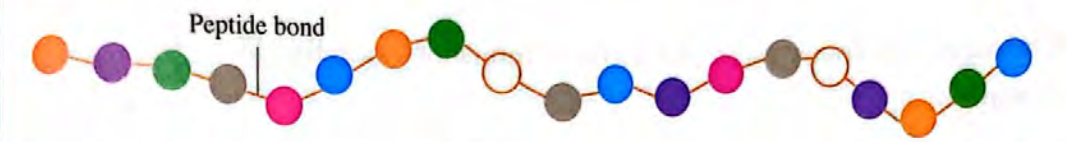
ⓐ Liver.
ⓑ Pancreas.
ⓒ Stomach.
ⓓ Small intestine.



11 In an experiment similar to that of Melvin Calvin, CO_2 with ^{18}O isotope and H_2O with ^{16}O isotope were used, what is the product that is formed first ?

ⓐ PGAL containing ^{16}O
ⓑ Glucose containing ^{16}O
ⓒ Glucose containing ^{18}O
ⓓ PGAL containing ^{18}O

12 Study the following figure, then answer :



Which of the following enzymes affects this compound to start its absorption ?

ⓐ Amylase.
ⓑ Pepsin.
ⓒ Trypsin.
ⓓ Peptidase.

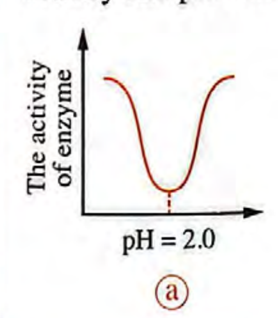
13 What is the result of sugar deficiency in the sap vacuoles of *Nitella* alga which lives in a swamp poor in chlorine, although the plant needs it ?

ⓐ Chlorine absorption increases.
ⓑ Water absorption decreases.
ⓒ Active transport process decreases.
ⓓ Strach production rate increases.

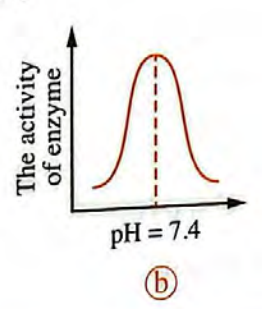
14 Which of the photosynthesis reactions its occurrence is synchronized with the conversion of ATP molecules into ADP ?

ⓐ H_2O splitting.
ⓑ NADP reduction.
ⓒ Photosynthetic phosphorylation.
ⓓ CO_2 reduction.

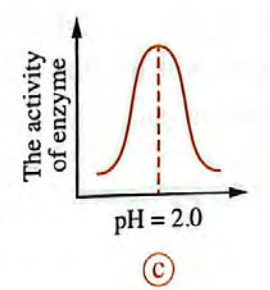
15 If you know that pepsin enzyme becomes active in a small range of high concentrations of hydrogen ion, which of the following graphs expresses the highest rate of pepsin activity and pH value ?



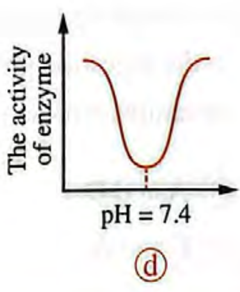
ⓐ



ⓑ



ⓒ



ⓓ

16 Which of the following plants are characterized by high osmotic pressures ?

ⓐ Normal plants and freshwater environment plants.

ⓑ Normal and desert plants.

ⓒ Desert plants and freshwater environment plants.

ⓓ Desert plants and salty water environment plants.

17 What is(are) the compound(s) that its(their) formation inside the chloroplast is affected by nitrogen deficiency ?

ⓐ Enzymes. ⓑ PGAL

ⓒ Glucose. ⓓ Starch.

18 What are the food substances that their components are re-built in order to work as an insulator which protects the body against cold weather ?

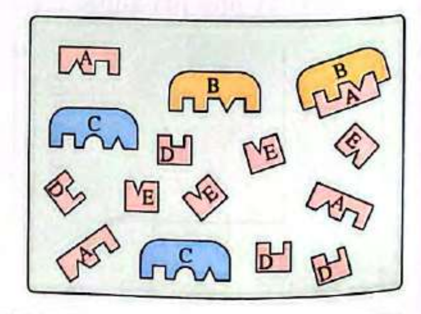
ⓐ Vegetables and fruits. ⓑ Meat and eggs.

ⓒ Meat and vegetables. ⓓ Peanuts and sesame.

19 Which of the following choices shows the changes that occur in the size of corn plant cells and their turgor (fullness) pressure when the sugar concentration increases inside the cells ?

	Cells' size	H_2O turgor pressure
ⓐ	Increases	Increases
ⓑ	Decreases	Decreases
ⓒ	Decreases	Increases
ⓓ	Increases	Decreases

20 The opposite figure illustrates the role of an enzyme in the digestion process, which of the opposite structures represent the products of this process ?



ⓐ A and D ⓑ C and B

ⓒ E and A ⓓ D and E

Answer the following questions (21 : 23) :

21 **What** is the functional suitability of the villus in the human ?

22 Although the purple sulphur bacteria are autotrophic, they differ from the green plants in the photosynthesis process. **Explain.**

23 **What happens if :** the number of chloroplasts in the palisade tissue is equal to their number in the spongy tissue ?

Chapter Two

Transport in Living Organisms



Lessons of the Chapter

Objectives of the chapter

By the end of this chapter, the student should be able to :

- Identify the concept of transport in higher plants.
- Deduce the mechanism of transport from the root to the leaf.
- Discover the forces that are responsible for the ascent of sap.
- Recognize the transport of the manufactured food from the leaf to other parts of the plant.
- Explain the role of sieve tubes in transport.
- Identify the structure of transport system in man.
- Identify the circulatory system.
- Identify the contents and functions of blood.
- Identify the heartbeats and blood pressure.
- Understand the blood circulation.
- Understand the mechanism of blood clot formation.
- Identify the components of lymphatic system.



Chapter 2

Lesson One

Transport in Plant

- It is clear from our previous studies for nutrition and digestion in living organisms that each living organism needs various substances that transport (move) inside its body by different means.

Transport in lower (primitive) plants

- Lower (Primitive) plants (like algae) don't need specialized transport tissues, as the raw materials (carbon dioxide, water and mineral salts) move with the products of photosynthesis from one cell to another by diffusion and active transport.

Transport in higher plants

- Gases (oxygen and carbon dioxide) move by diffusion.
- Water, mineral salts and soluble products of photosynthesis are transported through **specialized vascular tissues which are :**

1 Xylem tissues (vessels and tracheids)

They translocate water and mineral salts that are absorbed from the soil through the root across its different tissues, till they reach the xylem vessels in root, then to the xylem of stem, then to the leaves where the photosynthesis process takes place.

2 Phloem tissues (sieve tubes)

They translocate the high-energy organic food substances (carbohydrates, fats and proteins) from the sites of their production (leaves) to the sites of their storage and consumption in the different tissues of plant (root, stem, fruits and seeds) through the sieve tubes in the phloem of leaf, stem and root.

Test yourself



Choose the correct answer :

1 How far are these statements "carbohydrates are the essential substances that the plant forms in the photosynthesis process", "the plant can form proteins and fats through it" correct ?

(a) The two statements are correct.

(b) The first statement is correct and the second statement is wrong.

(c) The two statements are wrong.

(d) The first statement is wrong and the second statement is correct.

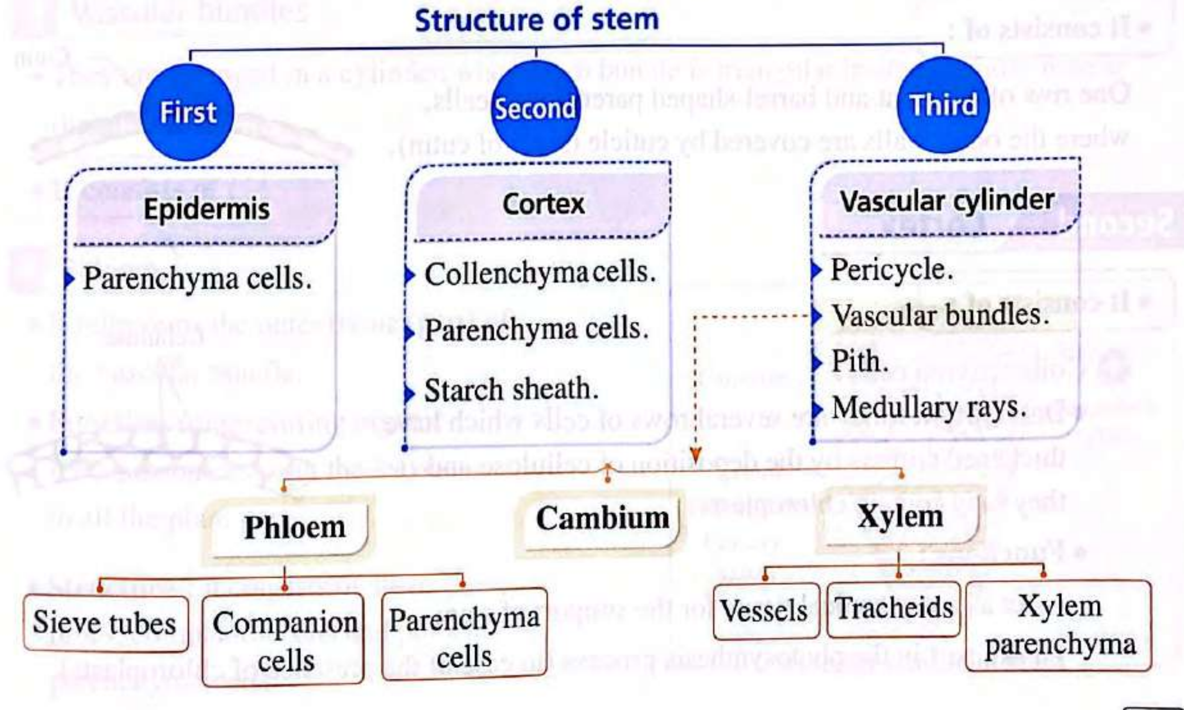
2 Which of the following represent the production and distribution lines in the plant respectively ?

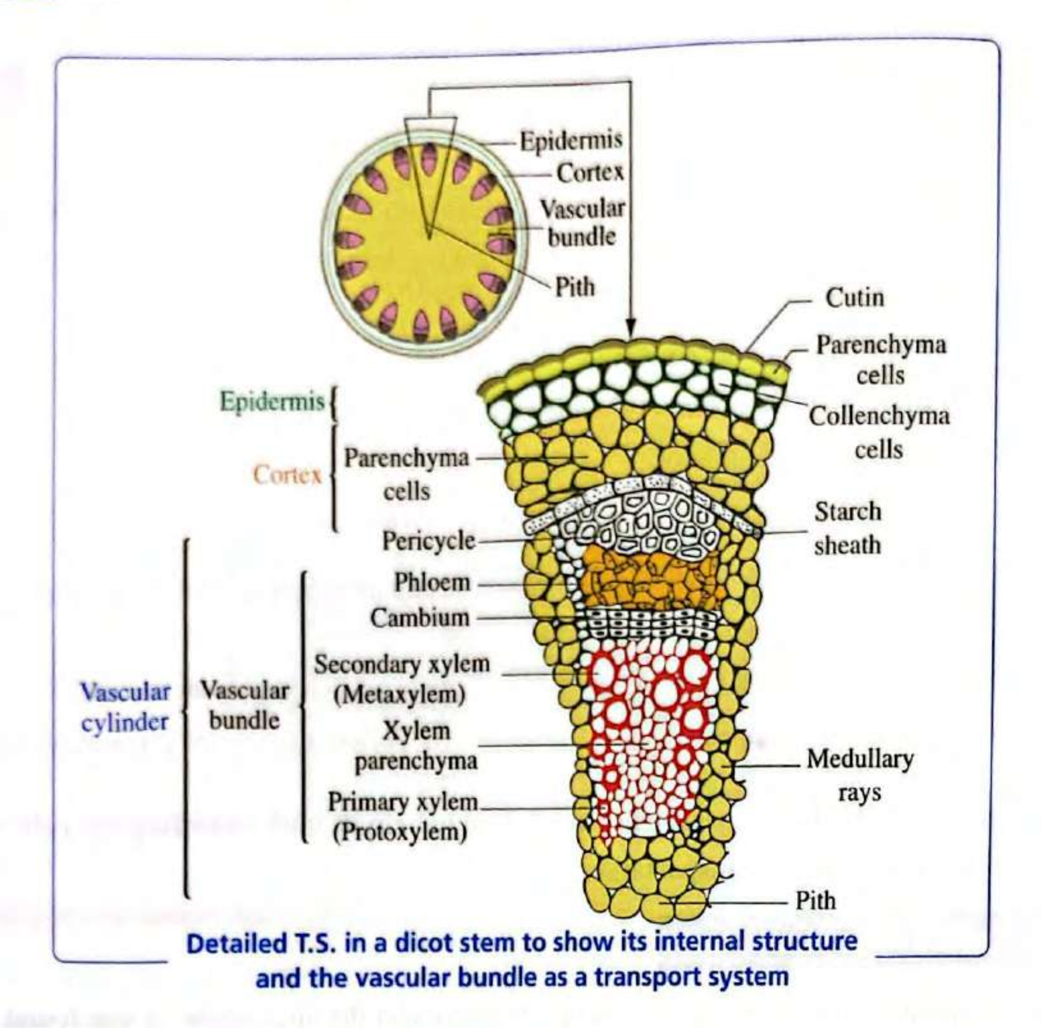
(a) Leaves and xylem tissues.
(b) Leaves and phloem tissues.
(c) Phloem tissues and leaves.
(d) Xylem tissues and phloem tissues.

- **We should study the internal structure of stem to help us understanding the role of stem in the process of transportation.**

Structure of the plant stem

- On examining a cross-section in a dicot plant stem under the microscope, it was found that it consists of a group of tissues, **as shown in the following diagram :**



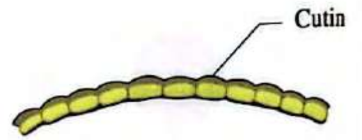


Detailed T.S. in a dicot stem to show its internal structure and the vascular bundle as a transport system

First Epidermis

• It consists of :

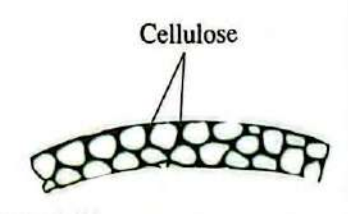
One row of adjacent and barrel-shaped parenchyma cells, where the outer walls are covered by cuticle (layer of cutin).



Second Cortex

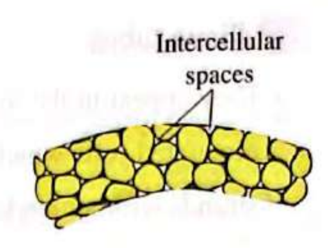
• It consists of :

1 Collenchyma cells :



- **Description :** they are several rows of cells which have thickened corners by the deposition of cellulose and they may contain chloroplasts.
- **Functions :**
  - Act as a mechanical tissue for the support of stem.
  - Take part in the photosynthesis process (in case of the presence of chloroplasts).

② Parenchyma cells :

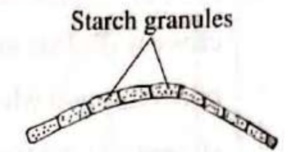


- **Description :** they are several rows of parenchyma cells with plenty of intercellular spaces.
- **Function :** aeration.



③ Starch sheath :

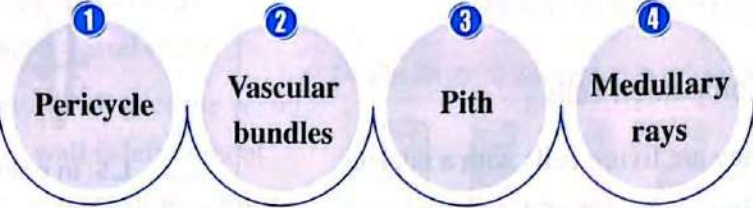
- **Description :** the innermost row of cells in the cortex.
- **Function :** storing and keeping the starch granules.



Third Vascular cylinder

- It occupies a large space of the stem.

- **It consists of :**



1 Pericycle

- **Description :**
  - A group of parenchyma cells alternates with groups of fibrous cells.
  - Each group of fibers faces a vascular bundle from outside.
- **Function :** makes the stem strong, erect and elastic.

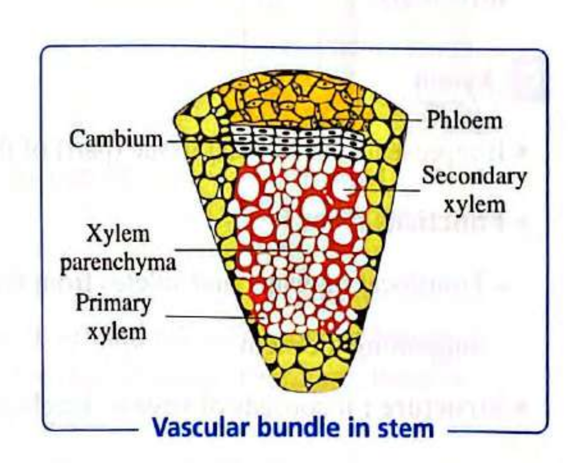
2 Vascular bundles

- They are arranged in a cylinder, where each bundle is triangular in shape whose base is directed outward.

- **It consists of :**

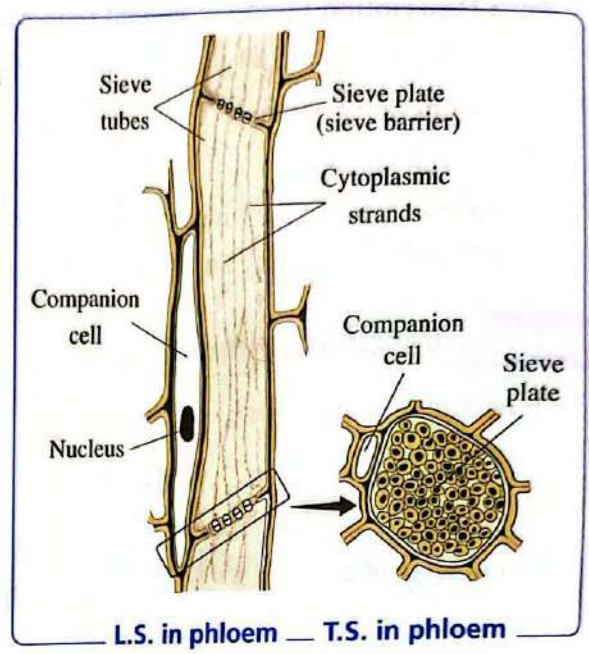
A Phloem

- It represents the outer tissue (part) of the vascular bundle.
- **Function :** transporting organic food substances from the leaves to all the plant parts.
- **Structure :** it consists of sieve tubes, companion cells and phloem parenchyma cells.



Vascular bundle in stem

Sieve tubes



- They appear in the longitudinal section as elongated cells which contain cytoplasmic strands without nuclei.
- They are separated from each other by cross-walls that are perforated by tiny pores through which the cytoplasmic strands extend from one tube to another, these perforated cross-walls are called **"sieve plates (barriers)"**.



Companion cells

- They are living cells with a nucleus, where each cell of them is accompanied by a sieve tube.
- They contain a large number of ribosomes and mitochondria which enable them to organize the vital processes of sieve tubes.

B Cambium

- **Description :** it consists of one row or more of **meristematic cells** that are found between the phloem and xylem.
- **Function :** its cells divide to give a secondary phloem **externally** and a secondary xylem **internally**.

C Xylem

- It represents the internal tissue (part) of the vascular bundle.
- **Functions :**
  - Translocating water and solutes from the root to stem, then to the leaves.
  - Supporting the stem.
- **Structure :** it consists of **vessels**, **tracheids** and **xylem parenchyma**.

Vessels

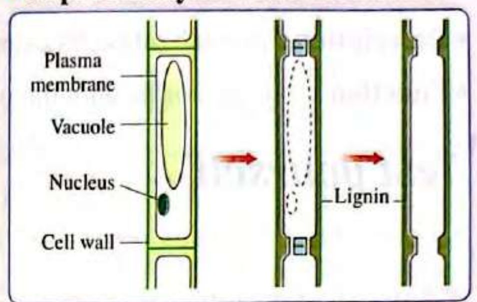
- **Structure :** they consist of a chain of elongated cylindrical cells that are joined end to end.
- **Steps of their formation :**

1. At first, the transverse walls of the cylindrical cells have been completely dissolved, so the cells become one tube.
2. The cellulose wall of cells is thickened by **lignin** substance which is **impermeable** to water and solutes.
3. The protoplasmic contents of cells died, leaving a hollow vessel (tube).

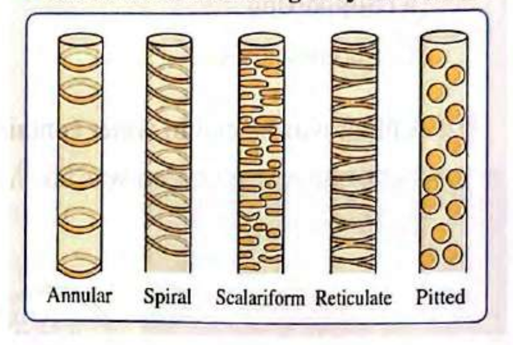
- Numerous pits are scattered all over the vessel wall, where the primary wall is left without thickening to allow the passage of water from inside the vessel to its outside.
- Strands of lignin are laid down on the inner lining of the vessel with various forms, such as annular and spiral to support the vessel and prevent the collapse (curve) of its wall inwards.

Do you know...?

• **Steps of the xylem vessel formation :**



• **The forms of thickening in xylem vessels :**

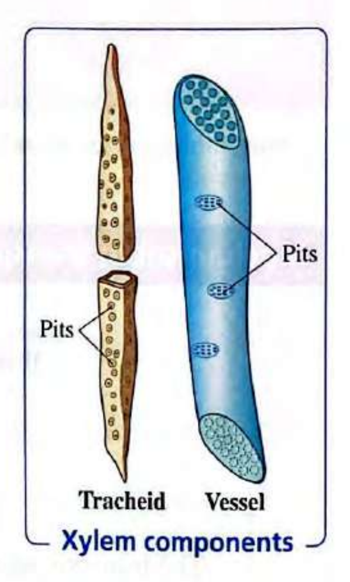


Tracheids

They are more or less similar to vessels, whereas they appear in T.S. different in being :

- Pentagonal or hexagonal form.
- Pointed (tapered), as the two ends are not opened.

They are similar to vessels in being pitted.



Xylem components

Xylem parenchyma

- **Description :** rows of parenchyma cells that are present between the xylem vessels.

Note

Xylem in the vascular bundles of stem is connected with the xylem of root and leaves. Also, the phloem of stem is connected with that of root and leaves. Therefore, there is a network of vessels that spreads all over the plant parts.

3 Pith

- **Description :** parenchyma cells occupy the centre of the stem.
- **Function :** storage.

4 Medullary rays

- **Description :** parenchyma cells extend among the vascular bundles.
- **Function :** join the cortex with the pith.



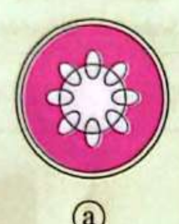
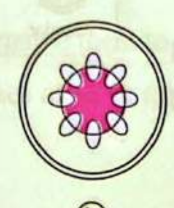
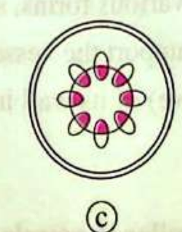
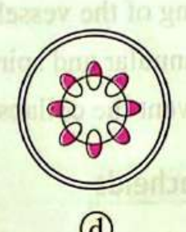
Test yourself



Choose the correct answer :

1. Which of the following **isn't** from the functions of the stem's cortex ?
   - (a) Supporting.
   - (b) Transport.
   - (c) Photosynthesis.
   - (d) Storage.

2. A plant was placed in water containing red dye for 24 hours, then it was removed, and a transverse section was taken from the stem. Which of the following figures illustrates that ?


(a)

(b)

(c)

(d)

Mechanism of transport in higher plants



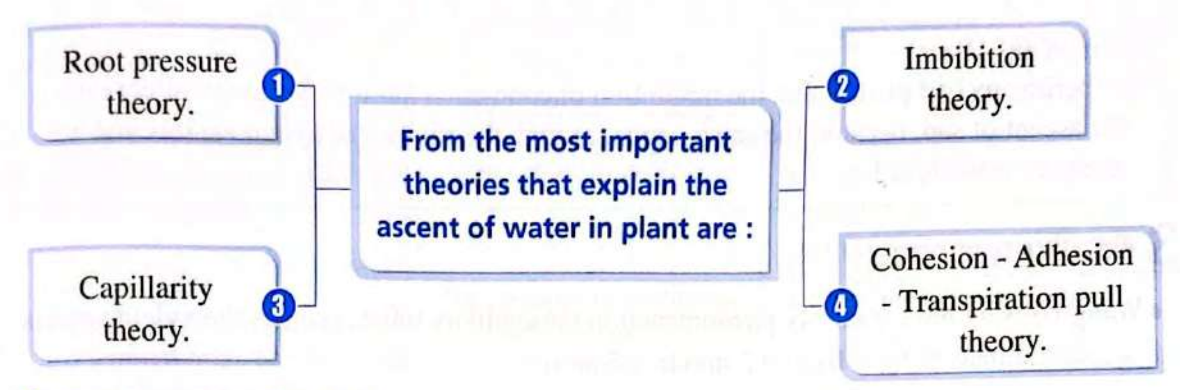
It includes two different processes, which are :

- The transport of **water** and **salts** from the root to the leaf.
- The transport of the **manufactured food** from the leaf to all the plant parts.

First Mechanism of water and salts transport from the root to the leaf

- Xylem is responsible for the translocation of water and salts from the root to the leaves by forces acting on the ascent of this sap.

Forces acting on the ascent of sap in the plant



1 Root pressure theory

- If the plant stem is cut very near (close) to the soil level, we can see the exudation (exit) of water from the stump (cut stem). This phenomenon is known as exudation which occurs, due to the **force** or **pressure** that is arisen in the root, as a result of its absorption of water by osmosis phenomenon, and this is called "**root pressure**".



Exudation phenomenon

- The root pressure causes water to be forced vertically upward through the xylem vessels, but it stops after a **short distance**, as at this level, the opposing pressure of the water column in xylem vessels has become equal to the root pressure.

Defect of the theory :

- Experiments had proved that the root pressure theory couldn't explain the ascent of water to high-levels in tall trees, **because :**
  - Root pressure doesn't exceed 2 atm in the best conditions.
  - Gymnosperm plants (Conifers), such as *Pinus* have no root pressure.
  - The root pressure is affected quickly by the external factors.

2 Imbibition theory

- The walls of xylem vessels consist of cellulose and lignin that have a colloidal nature which has the ability to imbibe water.
- This phenomenon explains the transport of water along the cell walls, until it reaches the walls of xylem vessels and tracheids of the root, and from it to the rest of plant parts.

Defect of the theory :

- Experiments had proved that the imbibition phenomenon has a very limited effect on the ascent of sap, because the sap ascends through the cavities of xylem vessels and not along their walls only.

3 Capillarity theory

- Water rises by the capillarity phenomenon in the capillary tubes, such as the xylem vessels whose diameter ranges from 0.2 mm to 0.5 mm.

Defect of the theory :

- Capillarity phenomenon is considered a weak secondary force for the ascent of sap, as the finest capillary tube doesn't allow the rise of water more than a height of 150 cm.

4 Cohesion - Adhesion - Transpiration pull theory

- The two scientists **H.H. Dixon** and **J. Joly** in 1895 established the principles of the cohesion - adhesion - transpiration pull theory, where they proved that "**water is pulled by the leaf, due to the consumption of water in the metabolic processes, transpiration and evaporation in leaves**".

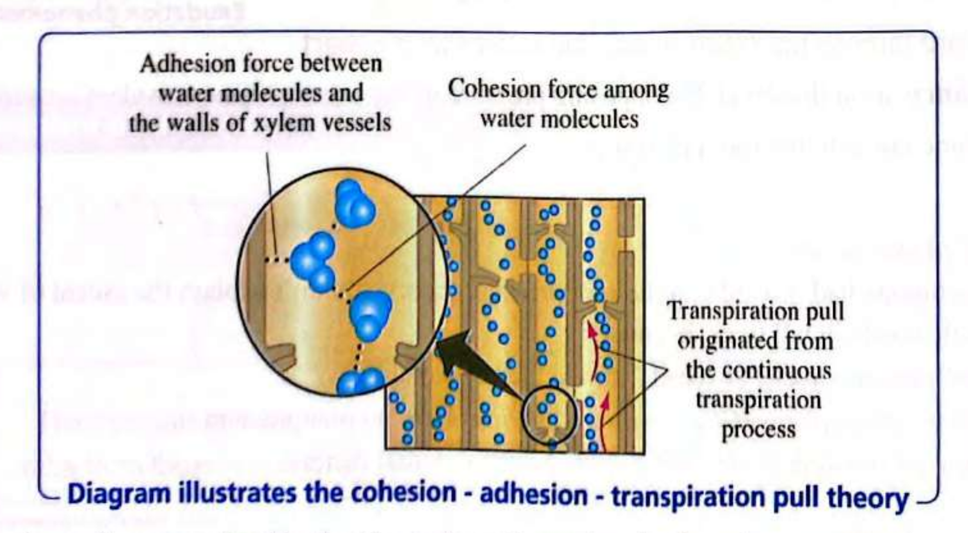


Diagram illustrates the cohesion - adhesion - transpiration pull theory

- The theory is summarized in that the water column rises in the xylem vessels **depending upon three forces, as shown in the following table :**

The force	The evidence on the presence of this force	The conditions needed for water to have a high pulling force in the xylem vessels
 Cohesion force among the molecules of water inside the xylem vessels and tracheids.	The presence of a continuous column of water inside the xylem vessels.	The tubes must be free of any gases or air bubbles to avoid the break and descend of the water column.
 Adhesion force between the water molecules and the walls of xylem vessels.	Water column is held continuously against the effect of gravity.	• Walls of the tubes must possess an adhesion force to attract water (colloidal nature). • Tubes must be capillary.
 Transpiration pull which originated from the continuous transpiration in the leaves.	The presence of continuous attraction of the water column upward.	

Proving the theory validation :

- The plant physiologists had proved that these forces are the main forces that work on pulling water in the stem for a very high distances which reach about 100 m.

Note

When some seedlings are transplanted from a nursery to an open soil, they fail to grow, if they exposed to Sun for a long time without planting, because of the entry of gases or formation of air bubbles inside the conducting tubes (xylem vessels and tracheids), causing the break of cohesion of water column molecules inside these tubes, preventing the arrival of sap, and finally the seedlings wilt and die.

Path of sap ascent from the root to the leaves



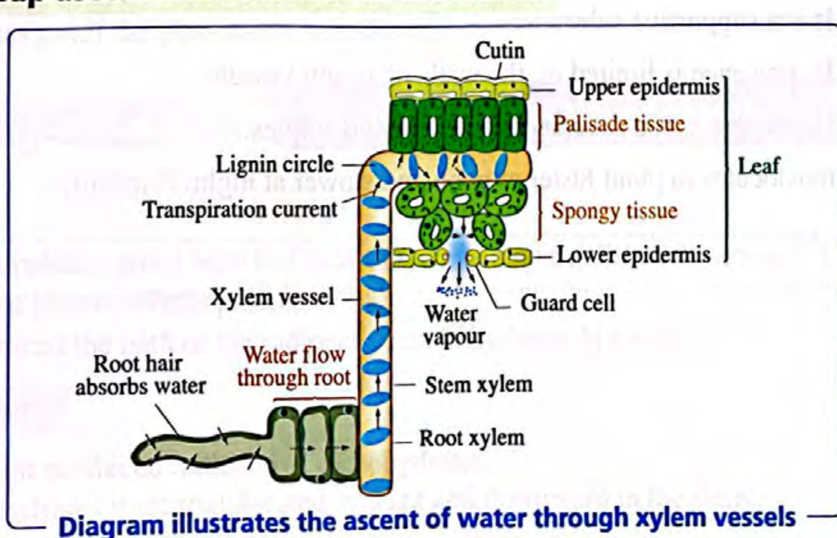


Diagram illustrates the ascent of water through xylem vessels

1. Leaves lose the water vapour that is present in the air chambers in the transpiration process through the stomata which lessens the water concentration (humidity) in the air chamber above the stomata in the leaf.
2. The air chambers pull water from the cells of mesophyll tissue that surround the stomata to compensate their water loss, as a result of increasing the evaporation process.
3. The water content of the mesophyll tissue cells will decrease and their sap concentration will increase.
4. The mesophyll tissue's cells will attract water from the surrounding cells, till reaching the xylem vessels in the venules and veins, then finally from the midrib of the leaf.
5. Water that is present in the xylem vessels will be subjected to a great pulling force, therefore water will ascend through xylem vessels and tracheids of both stem and root, as they are connected to each other.

Note

The transpiration pull that is originated from the transpiration in the leaf will not only pull-up water from the vascular cylinder of root, but also it will help in the lateral pull of water from the root hairs.

3 Test yourself



1 Choose the correct answer :

(1) Which of the following plants **isn't** exposed to exudation when its stem is cut close to the soil surface ?

ⓐ Maize. ⓑ Bean. ⓒ *Pinus*. ⓓ Wheat.

(2) Which of the following statements **doesn't** agree with the nature of cellulose ?

ⓐ It has a colloidal nature.

ⓑ It is a supportive substance.

ⓒ Its presence is limited on the walls of xylem vessels.

ⓓ It is a permeable substance for water and solutes.

2 Water translocates in plant faster at noon and slower at night. **Explain.**

....

....

Second Transport of the manufactured food from the leaf to all the plant parts

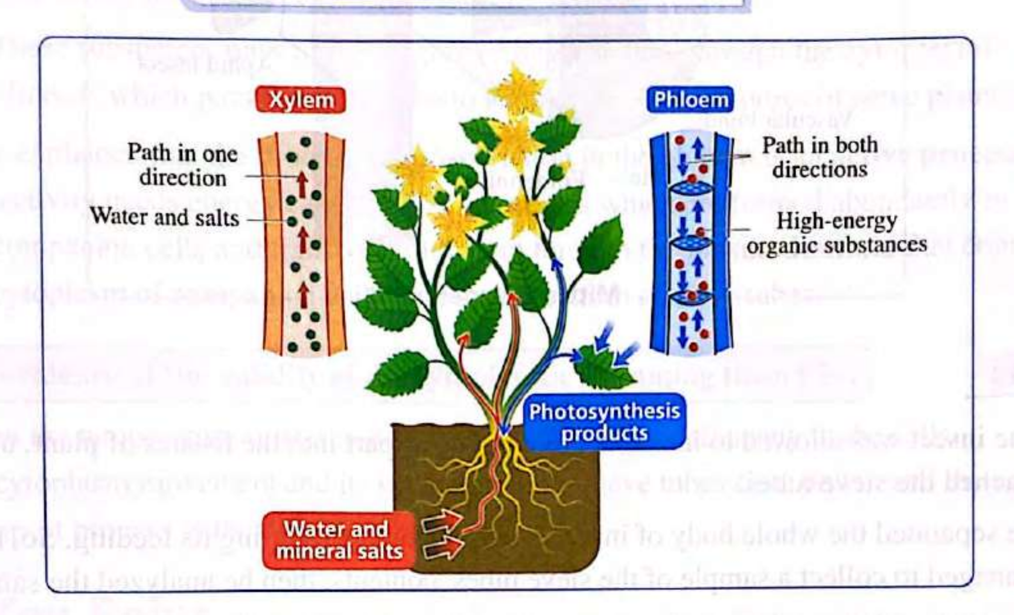
To feed the buds, flowers and fruits.

Upward

The phloem translocates the manufactured food "sap" (which consists of high-energy organic substances that are produced by the leaf during photosynthesis) in all directions :

Downward

To feed the stem and the root system.



Role of sieve tubes in the transportation of ready-made food substances

- Experiments had proved the role of sieve tubes in the transport of ready-made food substances to all the plant parts, **as follows :**



Experiment 1 The two scientists Rapeden and Bohr in 1945

1. Steps :

(1) They supplied a green bean leaf with CO_2 containing a radioactive carbon (^{14}C), in order to carry out photosynthesis process.

(2) They traced the path of the radioactive carbohydrates in the plant.

2. Observation :

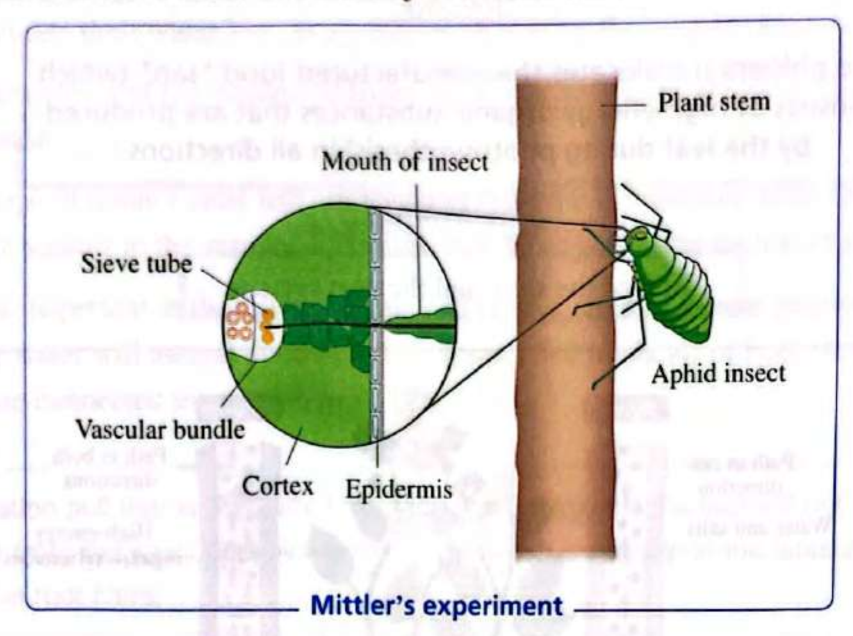
(1) The plant produced radioactive carbohydrates.

(2) Carbohydrates were translocated upward and downward in the stem.



Experiment 2 The scientist Mittler

- **He used an aphid insect (that feeds on the ready-made food of plant) to collect the contents of sieve tubes and identify these contents.**



Mittler's experiment

1. Steps :

(1) The insect was allowed to insert its piercing mouthpart into the tissues of plant, until it reached the sieve tubes.

(2) He separated the whole body of insect from its mouthpart during its feeding. So, he managed to collect a sample of the sieve tubes' contents, then he analyzed the sample.

(3) He sectioned the region of plant tissue where the proboscis of insect was inserted.

2. Observation :

(1) Food passes through the mouth of insect to its stomach.

(2) The sample of sieve tubes consists of organic substances (sucrose and amino acids) which are manufactured in the leaves.

(3) The proboscis appeared to be inserted in a sieve tube of the plant phloem.

3. Conclusion :

The sap that was absorbed by the insect is the sap of phloem which is transported to all the plant parts through the sieve tubes.

Mechanism of organic substances transport in the phloem

- In 1961, the two scientists **Thain** and **Canny** could see long cytoplasmic threads which contain organic substances inside the sieve tube, and these threads extend from one tube to another through the tiny pores of sieve plates. The active circular movement of cytoplasm inside the sieve tubes and companion cells that transport the organic food substances is known as **"cytoplasmic streaming"**.
- **Therefore, we can explain the mechanism of organic substances transport in the phloem on the basis of cytoplasmsic streaming, as follows :**

  1. The organic substances are **translocated** from one end of the sieve tube to the other end during the cytoplasmic streaming.
  2. These substances **pass** to the neighbouring sieve tube through the **cytoplasmic threads** which pass from one tube to another through the pores of sieve plates.

- They explained that the process of transportation in the phloem is an **active process**, as this activity needs energy carrier (ATP) molecules which are formed abundantly in the companion cells and transport from them through the **plasmodesmata** that connect the cytoplasm of companion cells with the cytoplasm of sieve tubes.

The evidence of the validity of the cytoplasmic streaming theory is :

- When the temperature is decreased or in case of oxygen deficiency in the cells, the cytoplasm movement and its streaming in the sieve tubes slow down, and the active transport process in the phloem is reduced.

Key Point

When the soil is saturated with water as a result of the excessive irrigation for the plant, the transport process decreases in phloem, because the excess water replaces the air that is found among the soil particles. Therefore, the oxygen decreases or vanishes in the plant cells, leading to the slowing down of the cytoplasm movement and its streaming in the sieve tubes.

4 Test yourself



Choose the correct answer :

What is the rate of the occurrence of transport process in the plants that live in moderate regions with respect to the plants which live in cold regions ?

ⓐ The rate is higher.
ⓑ The rate is lower.
ⓒ The rate is equal.
ⓓ The rate can't be predicted.

Chapter 2

Questions on Lesson One

Transport in Plant



The questions signed by ✳ are answered in detail. ● Understand ○ Apply ● Analyze



First Multiple Choice Questions

* **Transport in lower (primitive) and higher plants.**
* **Structure of the plant stem.**

1 From the opposite table :
Which of the following living organisms represent (X), (Y) and (Z) respectively ?

Living organism	Mechanism of transport
(X)	The raw materials are transferred by diffusion and active transport.
(Y)	Gases are transferred by diffusion, while raw materials are transferred through specialized transport tissues.
(Z)	Gases and food substances are transferred through specialized transport system.

ⓐ *Spirogyra* – Hawk – Bean.
ⓑ Bean – *Spirogyra* – Hawk.
ⓒ *Spirogyra* – Bean – Hawk.
ⓓ Hawk – *Spirogyra* – Bean.

2 On staining a transverse section of a dicot plant stem with iodine solution, which of the following appears with dark blue colour ?

ⓐ Xylem vessels.
ⓑ Companion cells of phloem.
ⓒ Cambium.
ⓓ The innermost row of cells in cortex.

3 Each of the xylem tissue and the phloem tissue performs the transport process in plant, which of the following statements is considered the correct description for this process ?

ⓐ Xylem transports water upward, while phloem transports food downward only.
ⓑ Xylem transports water and salts upward, while phloem transports the ready-made sap downward only.
ⓒ Xylem transports water and salts, while phloem transports the ready-made sap.
ⓓ Xylem transports the ready-made sap upward, while phloem transports water and salts downward only.

4 Which of the following statements **doesn't** agree with the cells forming the outer layer of each of the plant stem and leaf ?

ⓐ One row of parenchyma cells.
ⓑ Adjacent barrel-shaped cells.
ⓒ Coated cells with a layer that is impermeable to water.
ⓓ Barrel-shaped cells that have a storage function.

5 Which of the following participate(s) mainly in the transport of water in the plants stems ?

(a) Xylem tissue. (b) Vascular bundles.
(c) Vessels only. (d) Tracheids only.

6 Which of the following is found in the structure of the stem of a dicot plant ?

(a) A ring-shaped vascular bundle.
(b) Central vascular cells.
(c) Several layers of xylem that are surrounded by a ring of phloem.
(d) Vascular bundles that are arranged in a cylinder.

7 The following figure shows a group of cells that is adapted to perform a certain function :

(1) What do the cells no. (1) and (2) represent respectively ?

(a) Vessels and tracheids.
(b) Sieve tubes and companion cells.
(c) Epidermal cells and cortex cells.
(d) Sclerenchyma cells and medullary rays.

(2) What is the function of cells no. (1) and (2) ?

(a) Transporting food substances.
(b) Transporting water.
(c) Manufacturing food.
(d) Storing food.

(3) In which do cells no. (1) share with cells no. (2) ?

(a) In performing photosynthesis process. (b) In their transverse section.
(c) In being thickened with cutin. (d) In the stages of their formation.

8 Which of the following <u>doesn't</u> consist of parenchyma cells ?

(a) Stem's epidermis. (b) Leaf's epidermis.
(c) Cambium tissue. (d) Stem's pith.

9 From the opposite figure :

(1) What does letter (Z) represent ?

(a) Companion cell.
(b) Sieve tube.
(c) Xylem vessel.
(d) Tracheid.

(2) What does letter (L) represent ?

(a) Companion cell. (b) Sieve tube. (c) Xylem vessel. (d) Tracheid.

10 The opposite figure represents a section in a dicot plant stem :

(1) What is the number of the tissue that is specialized in transporting the organic food substances to the different plant parts ?

ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

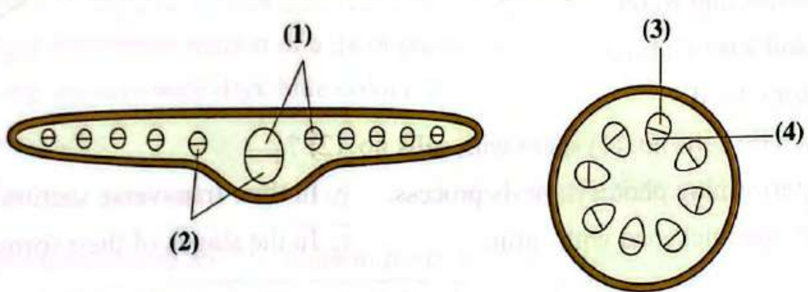
(2) What is the number of the tissue that shares indirectly in the transport process ?

ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

11 What is the similarity between the xylem tissue and phloem tissue in the plants' stems ?

ⓐ The walls of their cells contain cutin.
ⓑ Each of them is arisen from the same type of cells.
ⓒ Each of them transports the high-energy substances.
ⓓ Each of them transports the low-energy substances.

12 The two following figures illustrate two transverse sections in the tissues that transport water and the tissues that transport sucrose in two plant parts :



(1) Which of the following tissues transport water ?

ⓐ (1) and (3). ⓑ (2) and (4).
ⓒ (2) and (3). ⓓ (1) and (4).

(2) Which of the following tissues transport sucrose ?

ⓐ (1) and (3). ⓑ (2) and (4).
ⓒ (2) and (3). ⓓ (1) and (4).

13 Which of the following will stop, when the active meristematic cells are absent from a green herbaceous plant stem ?

ⓐ Water and salts transport. ⓑ Evolution of CO_2 gas.
ⓒ Photosynthesis process.
ⓓ Formation of specialized vascular tissues.

14 * Which of the following tissues is present in the plant stem and isn't present in the leaf ?

ⓐ Xylem. ⓑ Phloem. ⓒ Cambium. ⓓ Epidermis.

15 * Which of the following tissues have the ability to divide ?

ⓐ Tracheids. ⓑ Xylem vessels.
ⓒ Sieve tubes. ⓓ Companion cells.

Mechanism of transport in higher plants

16 In the opposite figure :

(1) Which of the following won't happen on removing structure no. (2) ?

ⓐ The tissue will lose its source of energy.
ⓑ The transport of organic substances will stop.
ⓒ The movement in structure no. (1) will stop.
ⓓ The tissue will change into xylem tissue.

(2) Structure no. (1) shares structure no. (2) in containing ....

ⓐ ribosomes. ⓑ cytoplasm. ⓒ mitochondria. ⓓ nucleus.

(3) Which of the following substances pass(es) from cell no. (2) to cell no. (1) through the cytoplasmic strands ?

ⓐ ATP ⓑ Salts. ⓒ Water. ⓓ Glucose.

17 When air bubbles entered in the xylem vessels, the plant loses .... force.

ⓐ adhesion ⓑ pulling ⓒ cohesion ⓓ root pressure

18 Which of the following determines the rate of water movement from roots to leaves ?

ⓐ Water absorption through the root hairs' cells.
ⓑ The low fullness pressure of water in leaves.
ⓒ Water diffusion through stomata.
ⓓ Water evaporation from the mesophyll tissue cells.

19 Which of the following substances have the ability to absorb water, but they are insoluble in it ?

ⓐ Cellulose and cutin. ⓑ Pectin and suberin.
ⓒ Pectin and lignin. ⓓ Cellulose and suberin.

20 Which of the following factors helps in accomplishing the cultivation of a plant in a pot after keeping it in a glass of water for two days ?

ⓐ Leaving the plant exposed to the Sun for a longer period of time.

ⓑ Planting its roots directly in a moist soil.

ⓒ Planting its roots directly in a dry soil.

ⓓ Covering the vegetative system with a bag before its planting.

21 Which of the following statements **doesn't** agree with the nature of lignin ?

ⓐ It is a substance with a colloidal nature that has the ability to imbibe water.

ⓑ It may take many shapes (as spiral and annular) inside the xylem vessel.

ⓒ It is a supportive substance that strengthens the xylem vessel and prevents its collapse.

ⓓ It is a permeable substance to water and solutes.

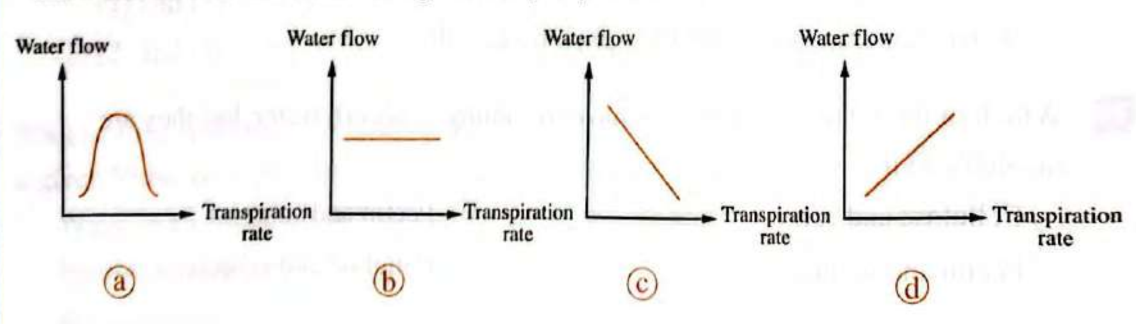
22 If the following diagram represents the direction of movement of food substances inside a tree, which of the following choices in the table expresses (A), (B) and (C) correctly ?

(A) — Inorganic substances → (B) — Inorganic substances → (C)

(A) ← Organic substances — (B) ← Organic substances — (C)

	(A)	(B)	(C)
ⓐ	Root	Leaf	Stem
ⓑ	Leaf	Stem	Root
ⓒ	Leaf	Root	Stem
ⓓ	Root	Stem	Leaf

23 Which of the following graphs illustrates the relation between the transpiration rate and the water flow in the stem during the early day hours ?



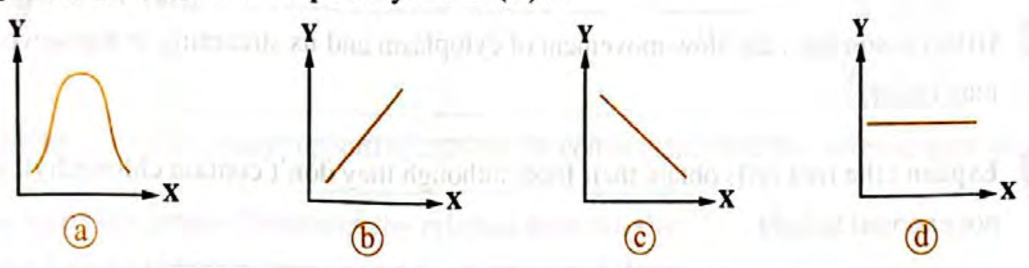
24 Which of the following **doesn't** agree with keeping the water columns held continuously inside the xylem vessels of the plant ?

ⓐ The adhesion force among water molecules.
ⓑ The cohesion force among water molecules.
ⓒ The presence of lignin substance in its structure.
ⓓ The xylem vessels are devoid of bubbles.

25 Which of the following the colloidal nature of xylem vessels' walls **doesn't** play a role in it ?

ⓐ The occurrence of imbibition phenomenon.
ⓑ The presence of cohesion force.
ⓒ The existence of water columns held against the effect of gravity.
ⓓ The presence of adhesion force.

26 Which of the following graphs shows the relation between the rate of the sap ascent in plant (X) and the rate of photosynthesis (Y) ?



27 Which of the following elements is(are) **not** found in the food of aphid insect, when it is examined ?

ⓐ Amino acids. ⓑ Fatty acids. ⓒ Sucrose. ⓓ Water.

28 Which of the following works on increasing the active transport process in the phloem ?

ⓐ Decreasing the temperature and oxygen deficiency.
ⓑ Decreasing the temperature and increasing oxygen.
ⓒ Increasing both the temperature and the concentration of oxygen.
ⓓ Increasing the temperature and decreasing oxygen.

29 * What is the main factor that helps in the ascent of water in the plant stem ?

ⓐ The difference in osmosis between the sap that is present in the cell and water that is present in the soil.
ⓑ The absorbed heat from the Sun. ⓒ The light absorbed by chlorophyll.
ⓓ The oxidation of the sugar that is resulted from photosynthesis.

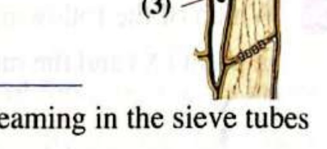
Second Miscellaneous Questions

1 "The *Spirogyra* alga contains developed vascular bundles".
How far is this statement correct ? With explanation.

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2 **Write what this statement indicates :** "Non-living plant structures whose inner surface nature is different from one plant to another".

3 **From the opposite figure :**



(a) What is the importance of structures no. (2) and (4) ?

(b) What is the role of plasmodesmata between the two structures no. (1) and (4) ?

(c) What happens in case of the absence of structure no. (3) ?

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4 **Give reason for :** the slow movement of cytoplasm and its streaming in the sieve tubes may occur.

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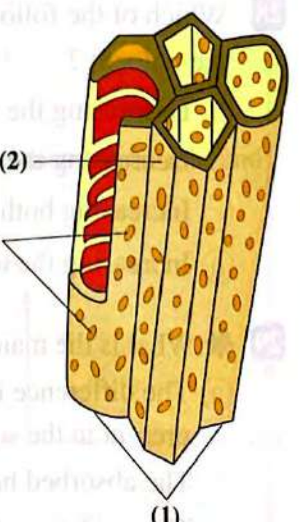
5 **Explain :** the root cells obtain their food, although they don't contain chlorophyll and are not exposed to light.

---

6 **Explain :** although xylem vessels and tracheids are non-living tissues, xylem tissue contains nuclei.

---

7 **The opposite figure represents two structures for transporting water and salts in the plant :**



(a) Deduce the reason for non-collapsing of the wall of structure no. (1) inward.

(b) Determine which of the two structures no. (1) or (2) has a greater role in the transport process in the plant. **Explain your answer.**

(c) Structure no. (1) is characterized by several characteristics that had a role in explaining the forces which work on the ascent of sap in the plant. **Explain this.**

"Two points are enough"

(d) What happens in case of the absence of structure (X) ?

8 **Deduce how the following structures are suitable for their functions :**

(a) Xylem vessels, "**two points are enough**".

(b) Tracheids. (c) Phloem.

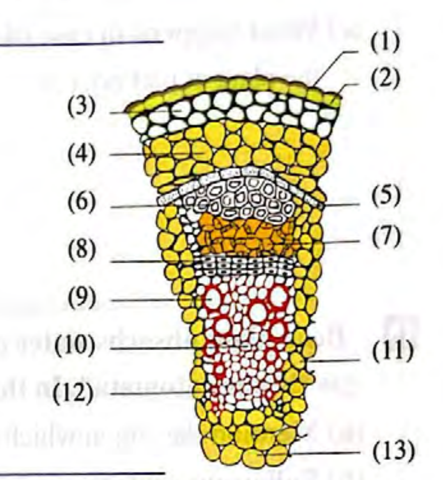
9 **"In plants, there are tissues that are related to the transport function". Determine :**

(a) The name of these tissues.

(b) The type of substances that are transported through these tissues.

(c) The transport direction in each of these tissues.

10 **The opposite figure illustrates the internal structure of the plant stem :**

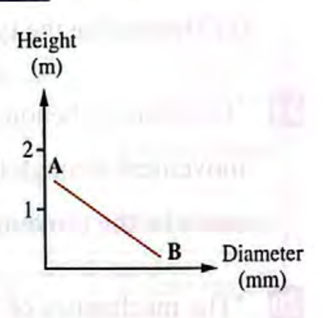


(a) **What** is the function of the two structures no. (3) and (5) ?

(b) The presence of the parenchyma tissue sites are numerous in this figure. **Illustrate this.**

11 **Explain :** there are many supportive cells for the cotton plant stem that differ in their sites.

12 **The opposite graph illustrates the relation between the water height in xylem vessels and the diameter of these vessels using a physical property :**



(a) **Explain** the curve (AB).

(b) **Why** didn't the curve elevate above point (A) ?

(c) **What** do you expect to happen if the diameter of the vessels was more than 1 cm ?

13 **Give reason for :** the hydrogen bonds that bind the water molecules with each other have a role in the ascent of the sap in plant.

14 **Give reason for :** the nature of xylem plays a role in the ascent of water inside the xylem vessels.

15 "Water is transferred from the root to the leaves, according to the following arrangement : cortex – stomata – mesophyll tissue – root hair – xylem". **How far is this statement correct ? With explanation.**

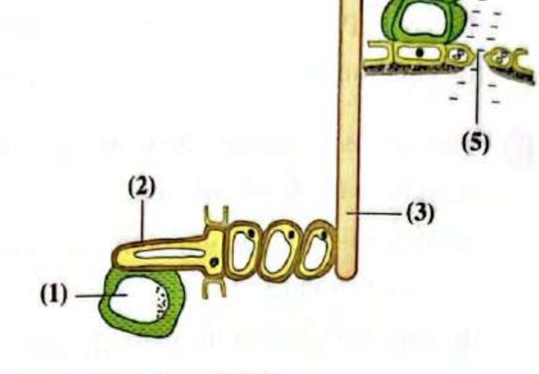
16 **Explain :** the radioactive elements have an important role in studying the transport process in bean plant.

17 **The opposite figure illustrates a diagram for the xylem vessels in a dicot plant :**

(a) **Mention** three forces acting on the ascent of water in xylem, in the light of your study for the theories of the sap ascent in the plant.

(b) **Deduce the functional suitability for :** Structures no. (2) and (4).

(c) **What happens in case of** cutting the plant at part no. (3) ?



18 **"Bean plant absorbs water and mineral salts by roots, and obtains carbon dioxide gas through stomata". In the light of this :**

(a) **Mention** the site in which carbon dioxide gas diffuses.

(b) **Follow** the route that is passed by water, salts and carbon dioxide, till reaching the site of their consumption in the plant.

(c) **Determine** the type of compounds that are formed as the final products.

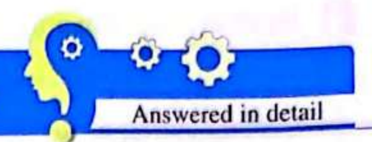
19 "Capillarity phenomenon and transpiration process play an important role in water movement through the plant". **Illustrate which of these two processes participates more in the movement of water upward in the tree trunk. Explain your answer.**

20 "The mechanism of transporting organic materials in phloem has been explained on the basis of cytoplasmic streaming". **How far is this statement correct ? With explanation.**

21 **What is the relation between :** companion cells and cytoplasmic streaming movement ?

22 **What is the relation between :** obtaining oxygen and transport process in the plant ?

23 **Explain :** the transport process in plant is affected by external factors.



Questions that measure **high levels of thinking**

Answered in detail

Choose the correct answer :

1 If you have two plants of the same type, through which of the following sections you can determine which plant is older than the other ?

(a) A longitudinal section in the midrib of the leaf.

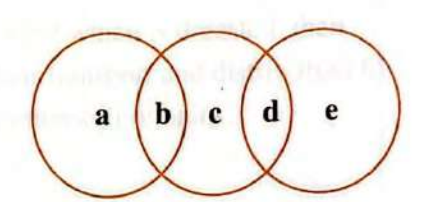
(b) A transverse section in the leaf.

(c) A longitudinal section in the stem.

(d) A transverse section in the stem.

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2 The opposite figure shows the relation among the sieve tubes, xylem vessels and companion cells, which choice in the following table represents the symbols (a : e) ?



	a	b	c	d	e
(a)	Companion cells	Cytoplasm	Sieve tubes	Absence of nucleus	Xylem vessels
(b)	Companion cells	Nucleus	Sieve tubes	Cytoplasm	Xylem vessels
(c)	Sieve tubes	Mitochondria	Companion cells	Nucleus	Xylem vessels
(d)	Xylem vessels	Absence of cytoplasm	Sieve tubes	Sap vacuole	Companion cells

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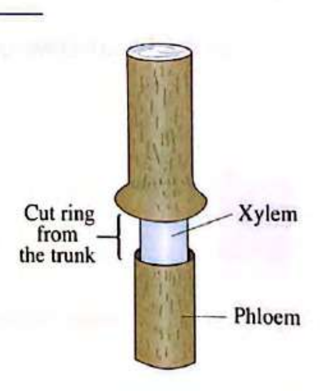
3 In the opposite figure, when removing a ring from the plant's trunk, which of the following is expected to happen ?

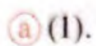
(a) Water will not reach the roots.

(b) Water will not reach the leaves.

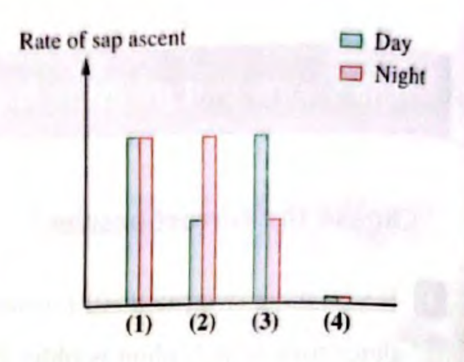
(c) Dissolved solutes will not reach the leaves.

(d) Amino acids and sugar will not be transported to the roots.





4 From the opposite graph, what is the letter representing the rate of sap (water and salts) ascent in plant during the day compared to the night ?



ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

5 A plant was irrigated by water containing radioactive hydrogen isotope (^3H), and the plant was put in normal light conditions, after several days, where will we find (^3H) ?

ⓐ In xylem only.

ⓑ In phloem only.

ⓒ In xylem and phloem.

ⓓ In the leaves' air chambers.



Chapter 2

Lesson Two

Human Transport System
(Circulatory System)

- Animals obtain their requirements of energy in the form of food which is digested, then soluble food substances are absorbed, but the problem of their transport and distribution to various tissues which are faraway from the surface of absorption still remains.

- In small animals (as Protozoa and *Hydra*) :

Both respiratory gases and food substances are transported by diffusion, therefore these small animals don't need to the specialized transport systems.

- In bigger and more complicated animals :

Diffusion is not sufficient for the transportation of food and oxygen to various tissues. Therefore, the presence of a specialized transport system is essential in these animals.

Key Point

The transport process in the living organism depends on the degree of its evolution and its body complexity.

- **Transport in human :**

The process of transport in the human body takes place through two systems which are closely connected with each other, **these systems are :**

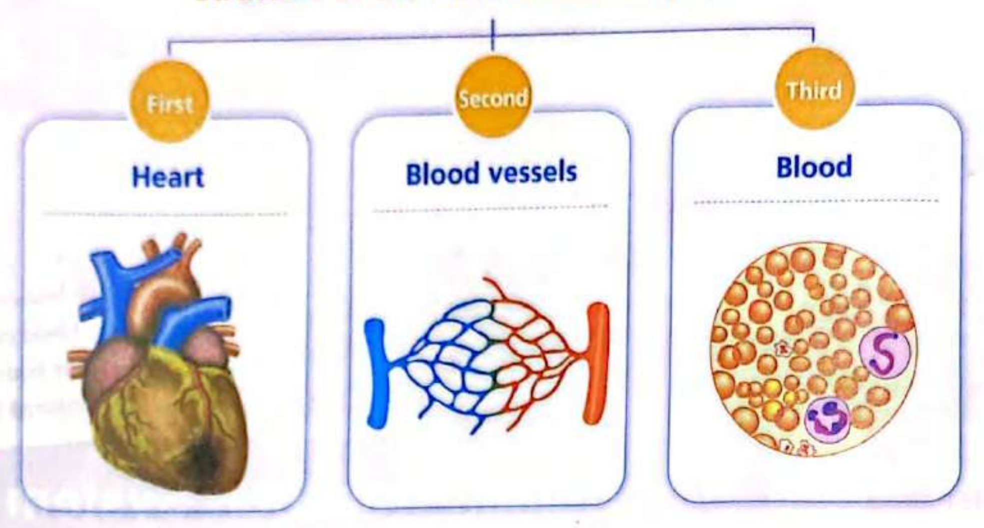
- Circulatory system (Blood vascular system).

- Lymphatic system.



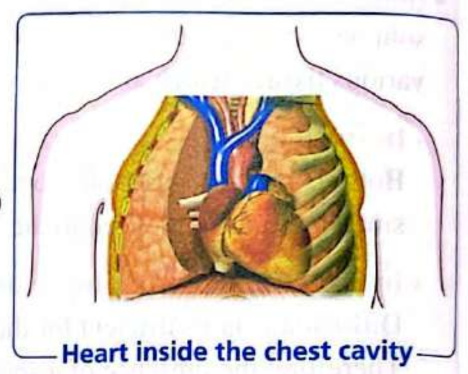
Circulatory system

- Circulatory system in human is considered from the closed type, as the heart and blood vessels are connected together in a complete cycle.



First Heart

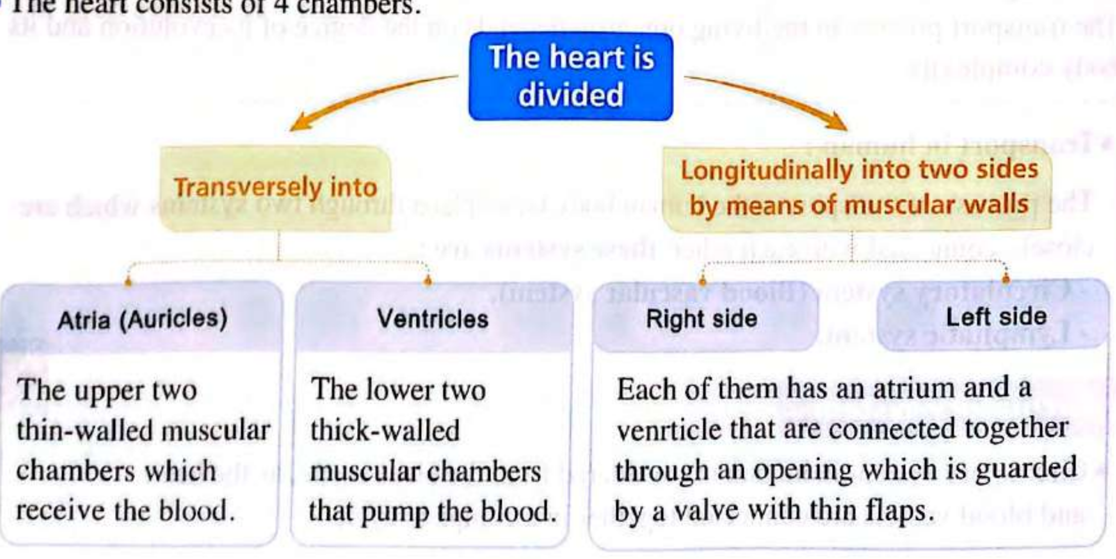
Description


Heart inside the chest cavity

- It is a hollow muscular organ which lies nearly in the middle of the chest cavity (slightly towards the left).
- It is surrounded by the pericardium (sac-like membrane) to protect the heart and facilitate its action (movement).
- The heart beats (contracts and relaxes) regularly throughout the whole lifetime.

Structure

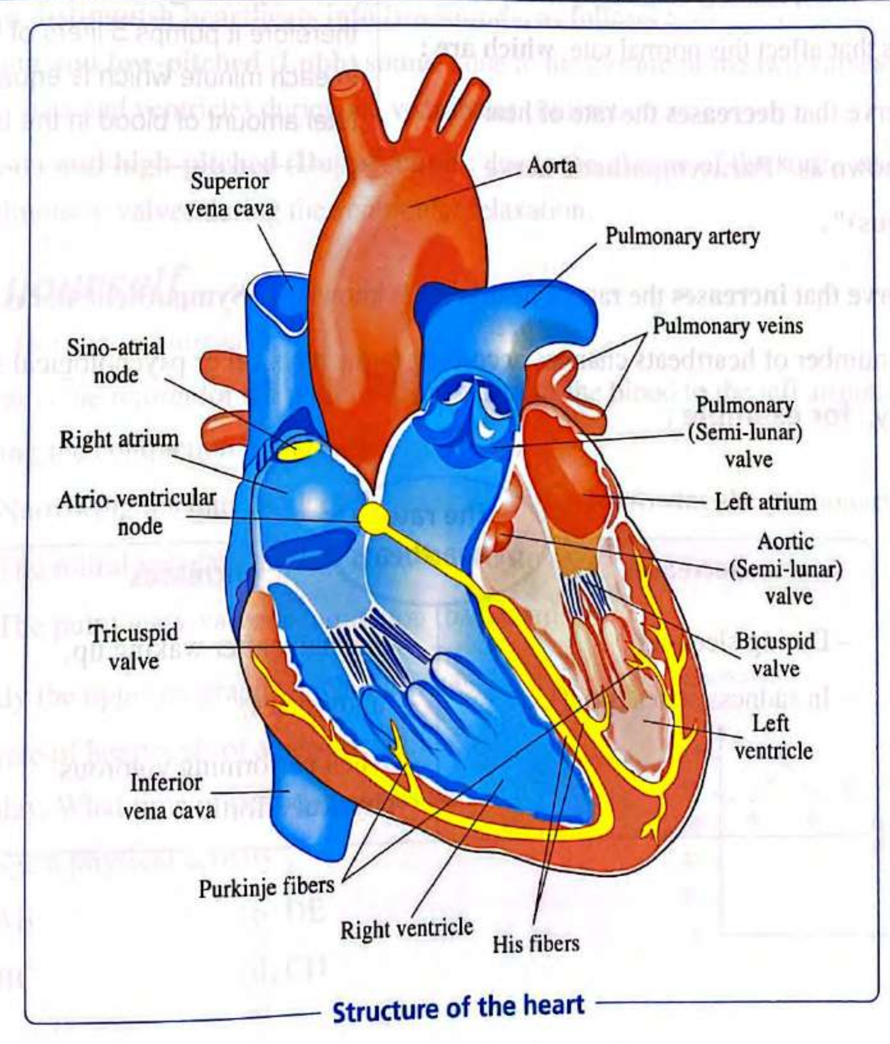
- The heart consists of 4 chambers.





• **Heart valves which include :**

		Location	Function
① Valves with flaps	**Right tricuspid valve** (consists of 3 flaps)	Lies between the right atrium and right ventricle.	Allows the blood to pass from the atrium to the opposite ventricle in one direction (**i.e.** it prevents the blood to return back to the atrium).
	Left bicuspid valve "Mitral valve" (consists of 2 flaps)	Lies between the left atrium and left ventricle.	
② Semi-lunar valves	**Pulmonary valve**	Presents at the connection of the heart with the pulmonary artery.	Allows the blood to pass from the ventricle to the artery that connected with it in one direction (**i.e.** it prevents the blood to return back to the ventricle).
	Aortic valve	Presents at the connection of the heart with aorta.	



Structure of the heart

Heartbeats



- The rhythmic and regular heartbeats are **originated from** the cardiac tissue itself, **because** the cardiac muscle is **spontaneous**, as well as it had been proven that the heart continues beating regularly, even after it has been disconnected completely from the body and from the nerves that are connected to it.

Origin of heartbeats

- The regular rhythm of heartbeat is related to the presence of **sino-atrial node which is :**
  - A specialized bundle of muscular fibers that is buried in the right atrial wall and near to the site of its connection with the large veins.
  - **Considered the pacemaker of the heart**, as it beats with a regular rate of 70 beats/minute (normal rate), and it is connected with two nerves that affect this normal rate, **which are :**
    - A nerve that **decreases** the rate of heartbeats is known as **"Parasympathetic nerve (vagus)".**
    - A nerve that **increases** the rate of heartbeats is known as **"Sympathetic nerve".**

Note

In the human normal age, the heart beats by a range of 70 beats/minute, therefore it pumps 5 liters of blood in each minute which is equal to the total amount of blood in the body.

So, the number of heartbeats changes according to the physical or psychological states of the body, **for example :**

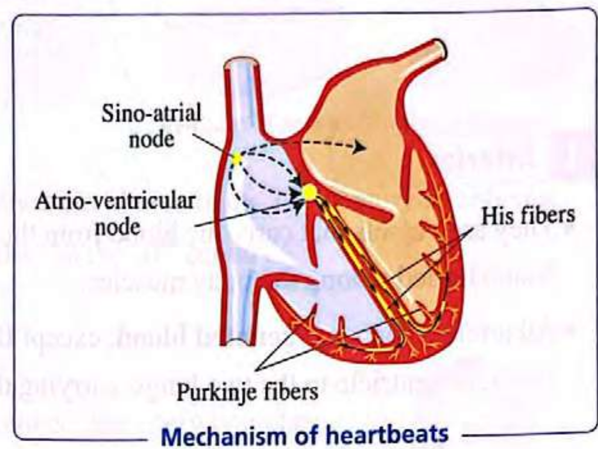
The rate of heartbeats

Decreases	Increases
– During sleeping. – In sadness states (grief).	– Gradually after waking up. – In joy states. – When performing vigorous physical efforts.

Mechanism of heartbeats



1. Sino-atrial node sends the contraction impulse spontaneously, therefore it stimulates the muscles of atria to contract.
2. The electrical nerve impulse reaches the **atrio-ventricular node** that is present at the site of connection of atria with ventricles.
3. The impulse spreads rapidly from the atrio-ventricular node through special fibers (**His fibers**), then spreads from the inter-ventricular septum to the wall of both ventricles through **purkinje fibers**, where it stimulates their muscles to contract.



Mechanism of heartbeats

Sound of heartbeats

- **We can distinguish heartbeats into two sounds, as follows :**
  1. **Long and low-pitched (Lubb) sound :** due to the closure of the two valves between the atria and ventricles during the ventricular contraction.
  2. **Short and high-pitched (Dupp) sound :** due to the closure of the aortic and pulmonary valves during the ventricular relaxation.

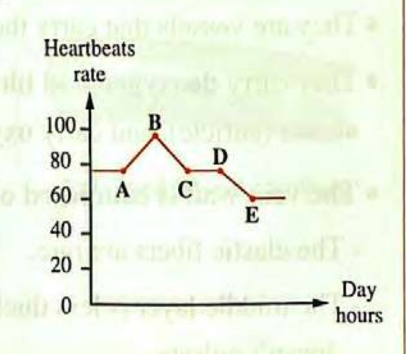
Test yourself

Answered

Choose the correct answer :

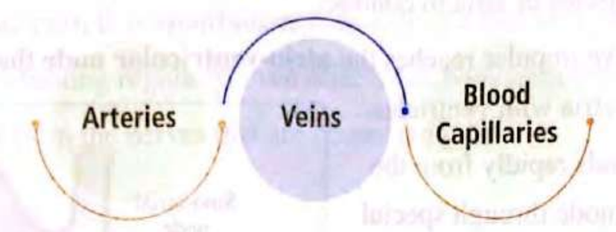
1. What is the reason for the return back of a part of the blood to the left atrium during the contraction of the ventricles ?
   - (a) Narrowing the mitral valve.
   - (b) Narrowing the pulmonary valve.
   - (c) The mitral valve regurgitation (backward flow).
   - (d) The pulmonary valve regurgitation (backward flow).

2. Study the opposite graph which illustrates the rate of heartbeats of a person within the day. What time of period does this person engage a physical activity ?
   - (a) AB
   - (b) DE
   - (c) BC
   - (d) CD



Second Blood Vessels

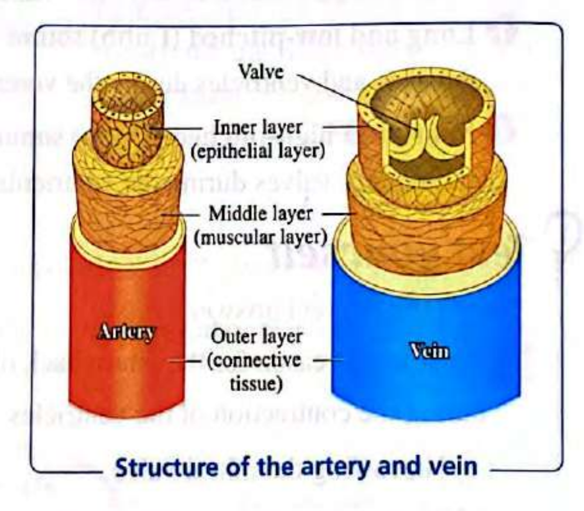
- **The blood vessels in the human body include :**



1 Arteries

- They are vessels that carry the blood from the heart to the other body parts and usually found buried among the body muscles.
- All arteries carry **oxygenated blood**, except **the pulmonary artery** which comes out from the right ventricle to the two lungs, carrying **deoxygenated blood.**

- **The artery wall is built up of three layers, as follows :**
  - **Outer layer :** it consists of a connective tissue.
  - **Middle layer :** it is relatively thick and consists of involuntary muscles which contract and relax under the control of nerve fibers, thus it can pulsate.
  - **Inner layer (Endothelium) :** it consists of one row of thin epithelial cells that is topped with elastic fibers which provide the artery with the required elasticity to be able to push the blood during the contraction of ventricles.



Structure of the artery and vein

2 Veins

- They are vessels that carry the blood from all the body parts to the heart.
- They carry **deoxygenated blood**, except **the pulmonary veins** which open in the left atrium (auricle), and carry **oxygenated blood.**
- **The vein wall is composed of the same layers of artery, but :**
  - The elastic fibers are rare.
  - The middle layer is less thick. So, the vein wall is thinner than that of the artery, and it doesn't pulsate.

- There are valves in some veins that allow the passage of blood in the direction of the heart and prevent its backflow, **such as** the limbs veins that are near to the skin surface, and the sites of these valves can be observed in the arm veins, when the arm is tied tightly with a bandage (tourniquet) above the elbow.

  This was done by the English doctor "**William Harvey**" who had studied the blood circulation in the 17th century after being discovered by the Arab doctor "**Ibn Al-Nafis**" in the 10th century.



William Harvey



Ibn Al-Nafis

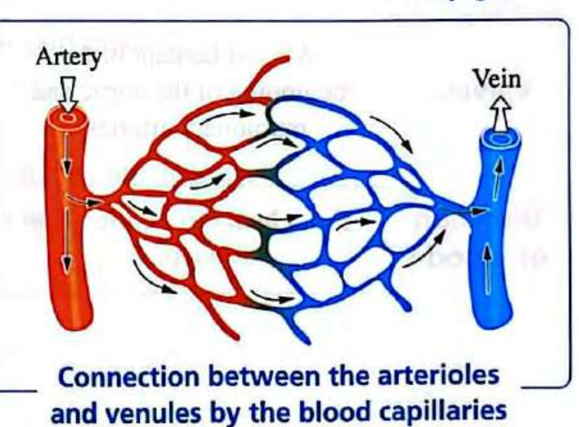
3 Blood capillaries

- They are tiny microscopic vessels which connect the artery branches (arterioles) with the vein branches (venules).
- This fact had been discovered by the Italian scientist "**Malpighi**" at the ends of the 17th century, and thus he completed the work of doctor "**Harvey**".



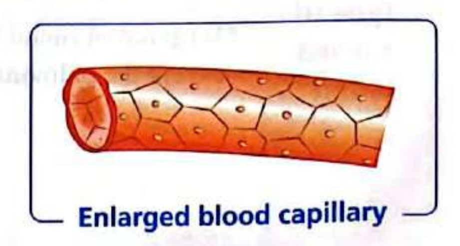
Malpighi

- Blood capillaries spread in the spaces among the cells of all the body tissues to be able to reach all the cells and supply them with their requirements of food and oxygen.



Connection between the arterioles and venules by the blood capillaries

- **Their wall :** it is very thin, consists of one cellular layer (whose thickness is about 0.00001 mm), and it is considered one row of thin epithelial cells with tiny pores between them which facilitates the quick exchange of substances between the blood and cells of tissues.



Enlarged blood capillary

- **Their diameter :** ranges from 7 : 10 micron.

From the previous, we can compare between arteries, veins and blood capillaries, as follows :



P.O.C.	Arteries	Veins	Blood capillaries
Structure of the wall :	**Consists of three layers :** - **Outer** : connective tissue. - **Middle** : thick and consists of involuntary muscles. - **Inner** : one row of epithelial cells that is topped with elastic fibers.	Has **the same** structure of the arterial wall, but has less elastic fibers (rare) and the middle layer is lower in thickness.	Consists of **one row** of thin epithelial cells with tiny pores between them.
Wall thickness :	**Thicker** than veins.	**Thinner** than arteries.	**Very thin.**
Ability to pulsate :	**Pulsate**	**Don't pulsate.**	**Don't pulsate.**
Valves :	**Absent** (except in the beginning of the aortic and pulmonary arteries).	The presence of internal valves **in some veins**, especially those that are present near to the skin surface.	**Absent**
Direction of blood :	From **heart** to **all the body parts**.	From **all the body parts** to **heart**.	From the **arterioles** to the **venules**.
Type of carried blood :	**Oxygenated blood** (light red), except the pulmonary artery.	**Deoxygenated blood** (dark red), except the pulmonary veins.	**Oxygenated blood** in the arterioles (except the arterioles inside the lung), and **deoxygenated blood** in the venules (except the venules inside the lung).
Location :	Found **buried** among the body **muscles**.	Some of them are present **near** to the skin surface.	Spread in the **spaces** among cells of **all the body tissues**.

Life application :

* **It is better to withdraw a blood sample from the vein than the artery in most medical tests, due to several reasons, which are :**
  - The vein is located near to the skin surface, while artery is buried and located deeply and faraway from the surface.
  - The vein is wider than the artery. Therefore, the vein contains a larger amount of blood.
  - The pressure in the vein is less than that in the artery. Therefore, the needle prick location during the withdrawal is healed faster than the artery after taking the sample.

Test yourself



Choose the correct answer :

Which of the following blood vessels contains the highest level of O_2 and the lowest level of CO_2 ?

(a) Aorta. (b) Pulmonary artery.
(c) Superior vena cava. (d) Inferior vena cava.

Third Blood

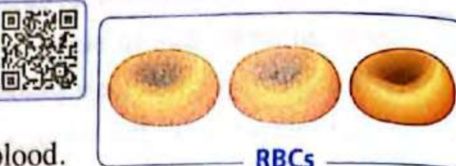


- It is considered the principal medium in the transport process.
- **Colour :** red viscous fluid.
- **pH :** equals 7.4 (weak alkaline).
- **Volume :** about 5 - 6 liters of blood are present in the human body.
- **Structure :** fluid connective tissue that **consists of :**
  - Plasma.
  - Red blood cells (corpuscles).
  - White blood cells (corpuscles).
  - Blood platelets.

1 Plasma

- It is the interstitial substance in blood.
- It represents **54%** of the blood volume and **consists of :**
  - **90% water**.
  - **1% inorganic salts**, such as Na^+, Ca^{2+}, Cl^- and $(HCO_3)^-$ salts.
  - **7% proteins**, such as albumin, globulin and fibrinogen.
  - **2% other components**, such as the absorbed food products (sugars and amino acids), hormones, enzymes, antibodies and wastes (urea).

2 Red blood corpuscles (Erythrocytes) (RBCs)



- **Number :** they are considered the most abundant blood cells, as the body of :
  - Adult male contains **4 : 5** million cells/mm^3 of the blood.
  - Adult female contains **4 : 4.5** million cells/mm^3 of the blood.
- **Description :** round-shaped corpuscles and biconcave.
- **Origin :** they are formed in the **bone marrow** of the adult human, where 100 million new red blood cells are produced every minute to replace the old ones.
- **Average age of the cell :** doesn't exceed 4 months, where they spend circulating inside the blood circulation about 172,000 times.

Note

After the breaking down of old red blood corpuscles, the body restores the proteins that found in RBCs to use them in the formation of the bile juice which plays an important role in the digestion of fats.

- **Destruction site :** they are destroyed after ending their short age in the liver, spleen and bone marrow.
- **Structure :** enucleated cells (have no nucleus) contain large amounts of "**haemoglobin**" which consists of protein and iron, and it gives the blood its red colour.
- **Functions :**

1 Transporting oxygen from the two lungs to all the body parts, as follows :

- The haemoglobin in the red blood corpuscle combines with the oxygen that is present in the two lungs to form a new light red substance "**oxyhaemoglobin**" (arterial blood).
- The oxyhaemoglobin leaves the oxygen, when it reaches the different body cells and changes into **haemoglobin** again.

2 Transporting carbon dioxide from all the body parts to the two lungs, as follows :

- The haemoglobin combines with the carbon dioxide that is present inside the body cells to form a new dark red substance "**carbo-aminohaemoglobin**" (venous blood).
- Carbo-aminohaemoglobin leaves carbon dioxide, when it reaches the two lungs and changes into haemoglobin again.

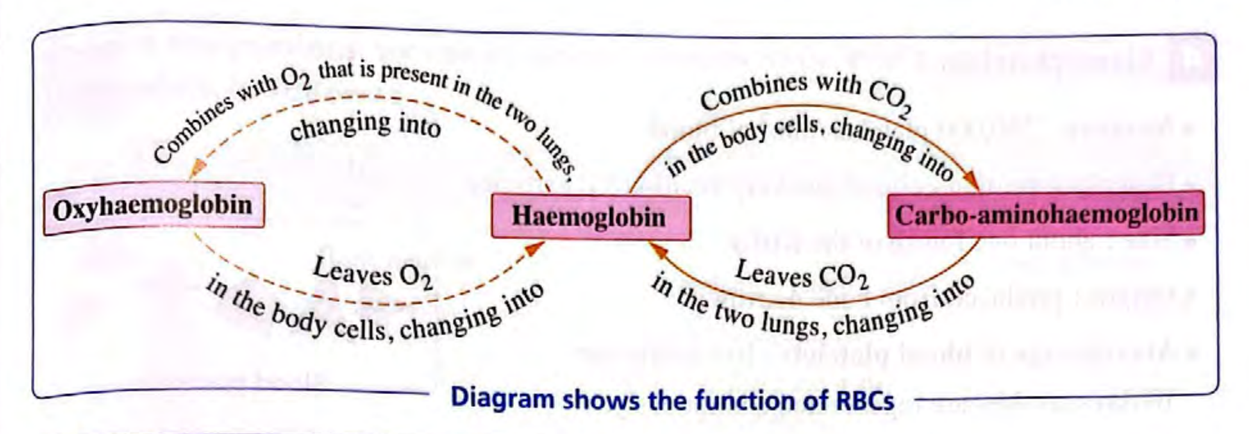
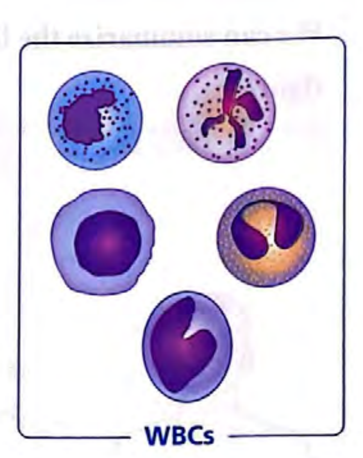


Diagram shows the function of RBCs

3 White blood corpuscles (Leucocytes) (WBCs)

- **Number :** they are about 7000 cells/mm^3 of blood, and this number increases during diseases.
- **Description :** colourless and nucleated corpuscles with many shapes (have no specific shape).
- **Origin :** they are formed in the bone marrow, spleen and lymphatic system.
- **Average age of the cell :** some of their types live for 13 : 20 days.



WBCs

- **Functions :** there are many types of leucocytes, where each type has a specific function, but their main function is the protection of the body against the infectious diseases, **as follows :**
  - Attacking microbes (by surrounding, then engulfing them).
  - Stopping the foreign substances that are produced by microbes in blood.
  - Getting rid of dead cells and other wastes.
  - Producing antibodies through specific types of white corpuscles.

Note

The white blood corpuscles circulate continuously in the body, streaming along the walls of blood vessels, as well as they have the ability to spread among the cells of blood capillaries walls.

4 Blood platelets

- **Number :** 250,000 platelets/mm^3 of blood.
- **Description :** non-cellular and very small-sized particles.
- **Size :** about one fourth of the RBCs.
- **Origin :** produced from bone marrow.
- **Average age of blood platelets :** live nearly for 10 days, as they are regenerated continuously.
- **Function :** play an important role in the blood clotting process after the injury.


Blood platelets

We can summarize the blood components in the adult person through the following figure :

Plasma 54%
7% Protein → Albumin, Globulin, Fibrinogen
90% Water
1% Inorganic salts → Na^+, Ca^{++}, Cl^-, $(HCO_3)^-$
2% Other components → Absorbed food products (sugars & amino acids), Hormones, Antibodies, Wastes (urea), Enzymes
Blood platelets 250,000 platelets/mm^3
White blood corpuscles 7000 cells/mm^3
Red blood corpuscles 4:5 million cells/mm^3

From the previous, we can compare between RBCs, WBCs and blood platelets, as follows :

P.O.C.	RBCs	WBCs	Blood platelets
Origin :	Bone marrow.	Bone marrow, spleen and lymphatic system.	Bone marrow.
Shape :	**Biconcave round**-shaped cells.	Don't have a **specific shape**, as there are many types of them.	**Non-cellular** and **small-sized** particles.
Number/ mm^3 of blood :	Adult male ⟶ **4 : 5** million cells. Adult female ⟶ **4 : 4.5** million cells.	**7,000** cells and this number increases in case of diseases.	**250,000**
Average age :	**120 days** (doesn't exceed 4 months).	Some types live for **13 : 20 days.**	**About 10 days**, as they are regenerated continuously.
Function :	• **Transport O_2** from the two lungs to the different body cells. • **Transport CO_2** from the different body cells to the two lungs.	• **Protecting the body through :** - Attacking microbes (by surrounding, then engulfing them). - Stopping the foreign substances that are produced by microbes. - Getting rid of dead cells and wastes. - Producing antibodies through specific types of white blood corpuscles.	Play an important role in **the blood clotting process** after injuries.
Colour :	**Red**, due to the presence of haemoglobin substance.	**Colourless**	——
Presence of nucleus :	**Enucleated**	**Nucleated**	——

Test yourself

Answered

1 Choose the correct answer :

What is the percentage of blood corpuscles and blood platelets in human blood ?

(a) 10% (b) 46% (c) 54% (d) 90%

2 From the opposite figure, what is the function of cells (X) ?

....

....

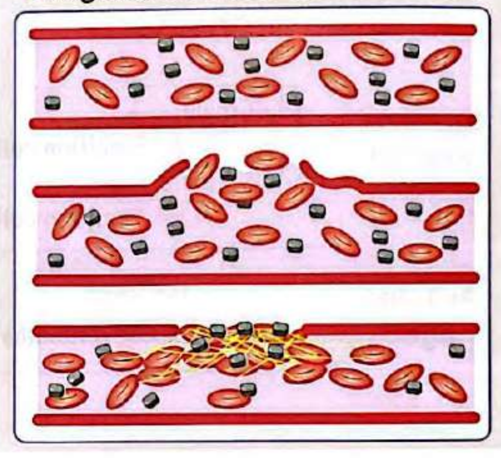
(X)

Blood clot

- It occurs when a blood vessel is cut or teared.
- **Importance of clotting :** protecting blood by preventing bleeding, in order not to lose a large amount of it which may expose the body to a shock that is followed by death.
- **Factors of coagulation (clotting) of blood :**
  1. Exposure of blood to air.
  2. Friction of blood with a rough surface, such as destroyed cells and vessels.

Do you know...?

- Stages of the blood clot formation :



Mechanism of blood clotting

- **In case of the presence of blood clotting factors, its steps are as follows :**

1. The blood platelets form a protein substance with the destroyed cells (at the injury site) called "**thromboplastin**".

Blood platelets + Destroyed cells $\xrightarrow[\text{factors in blood}]{\text{Clotting}}$ **Thromboplastin**

2. Thromboplastin stimulates the conversion process of **prothrombin** into **thrombin** in the presence of calcium ions (Ca^{++}) and blood clotting factors in plasma.

Prothrombin (Protein secreted by the liver with the help of vitamin (K) and poured in the blood) $\xrightarrow[Ca^{++}\text{, clotting factors}]{\text{Thromboplastin}}$ **Thrombin** (Active enzyme)

❸ Thrombin catalyzes the conversion of **fibrinogen** into **fibrin**.

Fibrinogen (Soluble protein in plasma)	—Thrombin→	**Fibrin** (Insoluble protein)

❹ Fibrin precipitates in the form of a network of microscopic interlacing fibers in which the blood cells are aggregated, forming a clot which blocks the cut in the damaged blood vessel to stop the bleeding.

Reasons for the non-clotting of blood inside the blood vessels

❶ Blood flows normally inside the blood vessels without slowing down.

❷ Blood platelets slide easily and smoothly inside the blood vessels without being broken.

❸ The presence of **heparin** substance that is secreted by the liver and prevents the conversion of prothrombin into thrombin.

4 Test yourself



Choose the correct answer :

1 Which of the following is expected to be a reason for haemophilia (blood liquidity) disease ?

(a) Increasing the calcium level in blood.

(b) Increasing the level of vitamin (K) in blood.

(c) Increasing the blood platelets level in blood.

(d) The absence of one of the blood clotting factors from blood.

2 Which of the following substances can be used to prevent the clotting of blood samples in the tubes, during carrying out some laboratory tests ?

(a) Thromboplastin. (b) Prothrombin.

(c) Fibrinogen. (d) Heparin.

Functions of blood

- **The blood has several functions, due to its unique structure, which are as follows :**

1. **Transportation** →
   - It transports the digested food substances, excretory nitrogenous compounds, hormones and some enzymes (active or inactive) by the plasma.
   - It transports oxygen and carbon dioxide by RBCs.

2. **Regulation** →
   - It regulates the processes of metabolism.
   - It keeps the body temperature at 37°C.
   - It regulates the internal environment (homeostasis) of body, such as (osmotic potential, amount of water and the value of pH in the tissues).

3. **Protection** →
   - It protects the body against the invasion of microbes and pathogenic organisms through the white blood corpuscles.
   - It protects the blood itself against bleeding by the help of blood platelets which play an important role in the formation of blood clot.

Blood pressure



- Blood circulates within the arteries, veins and minute blood capillaries by the **heartbeats**, but :
  - It passes smoothly and easily in the arteries and veins.
  - It doesn't pass smoothly and easily in the minute blood capillaries, due to their resistance against this heavy viscous fluid. So, it needs a pressure which is called "**blood pressure**".

The blood pressure increases 

On the **contraction** of the two ventricles (heartbeats). So, the highest blood pressure is measured in the arteries that are near to the heart.

The blood pressure decreases 

On the **relaxation** of two ventricles, and the blood pressure decreases as we go far from the arteries that are near to the heart, till reaching its minimum value in the venules and blood capillaries (about 10 mm Hg). So, the returning back of the blood in veins to the heart depends on the muscles that surround the veins and the valves that are present in these veins.

Measurement of blood pressure

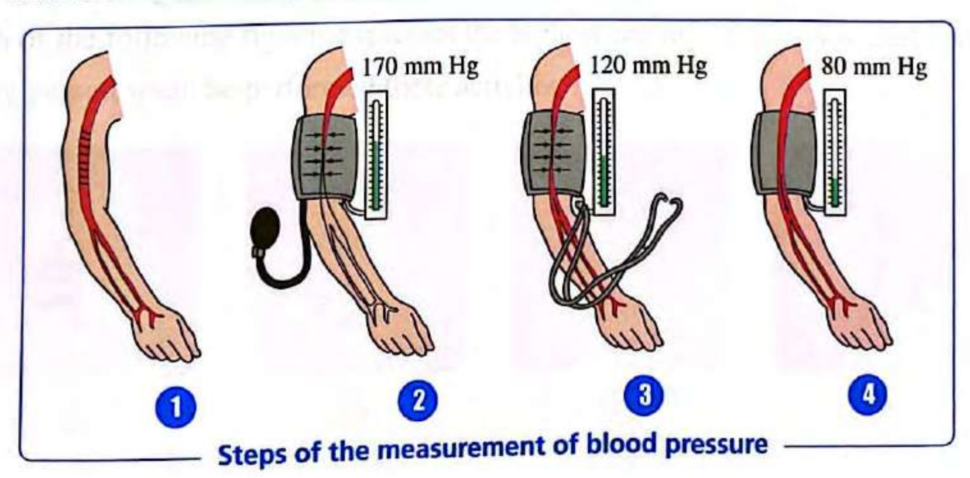
- **The blood pressure is measured by means of mercuric instruments called "sphygmomanometers", which give two numbers :**
  - **Upper number :** measured during the **ventricular contraction** (systolic) which represents the **maximum** blood pressure.
  - **Lower number :** measured during the **ventricular relaxation** (diastolic) which represents the **minimum** blood pressure.
- **Example :** the normal value of blood pressure in a healthy youth is **120/80** mm Hg. So, the number of **120** mm Hg represents the blood pressure during ventricular contraction **(systolic)**, and **80** mm Hg represents the blood pressure during ventricular relaxation **(diastolic)**.

Sphygmomanometer

- **Structure :** a mercuric tube and a scale board.
- **Idea of working :** blood pressure can be measured according to the elevation of mercury level inside the tube and it is represented by a number on the scale board.
- **Method of measurement :**



The blood pressure can be measured by listening to the heartbeats, and also between one beat and another, **as follows :**
  - The doctor listens to the sound of heartbeats by the stethoscope.
  - On hearing the sound of heartbeat, the doctor can determine the number, referring to the ventricles contraction **(systolic)**.
  - When the sound disappears, the doctor can determine the number, referring to the ventricles relaxation **(diastolic)**.



Steps of the measurement of blood pressure

Notes

(1) The blood pressure increases gradually by aging, and it may reach a dangerous case, if it is not cured under medical control.

(2) There are some digital devices to measure the blood pressure, but they are not accurate as the mercuric device.



Test yourself



Choose the correct answer :

What is the lowest value of the blood pressure in human ?

ⓐ On contracting the left atrium.

ⓑ On relaxing the right atrium.

ⓒ On the closure of the bicuspid valve.

ⓓ On the opening of the pulmonary valve.

Human Transport System
(Circulatory System)



The questions signed by ✳ are answered in detail. ● Understand ● Apply ● Analyze


Interactive test

First Multiple Choice Questions

Heart and blood vessels

1 Which of the following is considered the correct path for the transfer of the contraction impulse to the muscles of ventricles ?

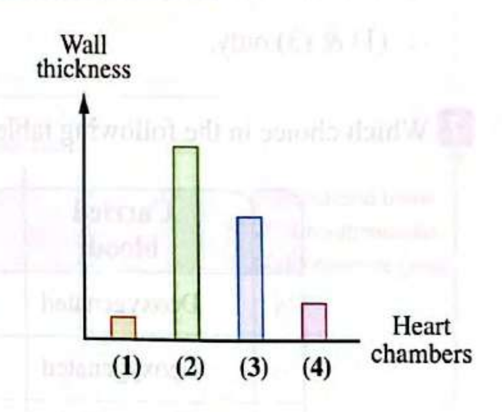
ⓐ Sino-atrial node ⟶ His fibers ⟶ Purkinje fibers ⟶ Wall of ventricles.

ⓑ Purkinje fibers ⟶ Sino-atrial node ⟶ His fibers ⟶ Wall of ventricles.

ⓒ Sino-atrial node ⟶ His fibers ⟶ Atrio-ventricular node ⟶ Wall of ventricles.

ⓓ Atrio-ventricular node ⟶ His fibers ⟶ Purkinje fibers ⟶ Wall of ventricles.

2 Study the opposite graph that illustrates the difference in the thickness of the human heart chambers walls, what is the heart chamber that pumps the blood to the two lungs ?



ⓐ (1). ⓑ (2).

ⓒ (3). ⓓ (4).

3 Which of the following figures expresses the highest activity of the sino-atrial node in this healthy person when he performed these activites ?


ⓐ

ⓑ


ⓒ


ⓓ

4 Which of the following statements **isn't** applied to the valves ?

ⓐ They are present at the connection of the heart with the pulmonary and aortic arteries.

ⓑ They are present at the connection of the heart with the superior and inferior venae cavae.

ⓒ They allow the passage of blood from the atrium to its opposite ventricle.

ⓓ They allow the passage of blood from the two ventricles to inside the arteries in one direction.

5 Which of the following statements is correct about the veins of the left leg ?

ⓐ They carry blood at high pressures. ⓑ They are pulsating.

ⓒ They contain valves.

ⓓ They carry blood away from the heart.

6 Which of the following characteristics allows the artery to adapt with the change in the blood pressure during the passage of blood through it ?

(1) Thinning of the inner layer wall. **(2)** The presence of elastic fibers.

(3) The thickening of the muscular layer wall.

ⓐ (1), (2) & (3). ⓑ (1) & (2) only.

ⓒ (1) & (3) only. ⓓ (2) & (3) only.

7 Which choice in the following table is applied to the pulmonary artery ?

	Carried blood	Muscular layer in the wall	The size of the internal cavity
ⓐ	Deoxygenated	Thick	Small
ⓑ	Deoxygenated	Thin	Large
ⓒ	Oxygenated	Thick	Small
ⓓ	Oxygenated	Thin	Large

8 Which of the following **doesn't** agree with the characteristics of the pulmonary vein ?

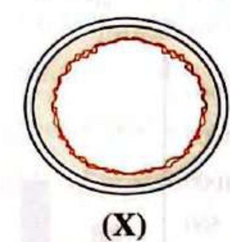
ⓐ It carries oxygenated blood.

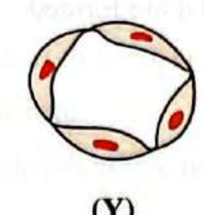
ⓑ It has a wider lumen than that of the pulmonary artery.

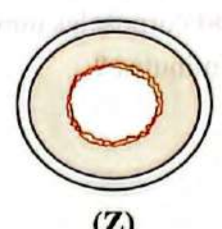
ⓒ It carries blood under high pressure.

ⓓ The thickness of its wall is thinner than that of the pulmonary artery's wall.

9 The following figures show transverse sections in three blood vessels :


(X)


(Y)


(Z)

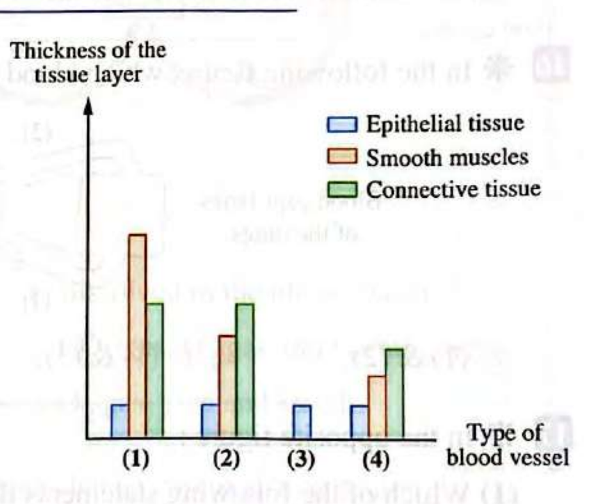
Which of the following refers to the correct arrangement for each of (X), (Y) and (Z) respectively ?

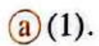
ⓐ Artery – Blood capillary – Vein.
ⓑ Blood capillary – Vein – Artery.
ⓒ Vein – Blood capillary – Artery.
ⓓ Vein – Artery – Blood capillary.

10 Which of the following is considered from the characteristics of the blood vessels that connect between the artery and vein ?

ⓐ They contain valves.
ⓑ Their wall consists of several cellular layers.
ⓒ Their wall consists of connective tissue.
ⓓ Their wall contains tiny pores.

11 The opposite graph illustrates the relation between the thickness of the tissue layer that forms different types of blood vessels in the human body, which one transfers the oxygenated blood to the kidney ?



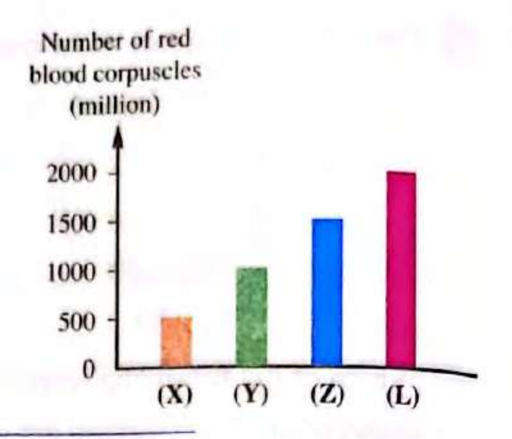


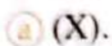
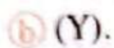
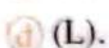
ⓐ (1).
ⓑ (2).
ⓒ (3).
ⓓ (4).

12 The pulmonary artery contains ....

ⓐ a bicuspid valve.
ⓑ blood with high pressure.
ⓒ blood moving towards the heart.
ⓓ oxygenated blood.

13 In the opposite graph, which column represents the red blood corpuscles number that are formed through 15 minutes ?




ⓐ (X).

ⓑ (Y).
ⓒ (Z).

ⓓ (L).

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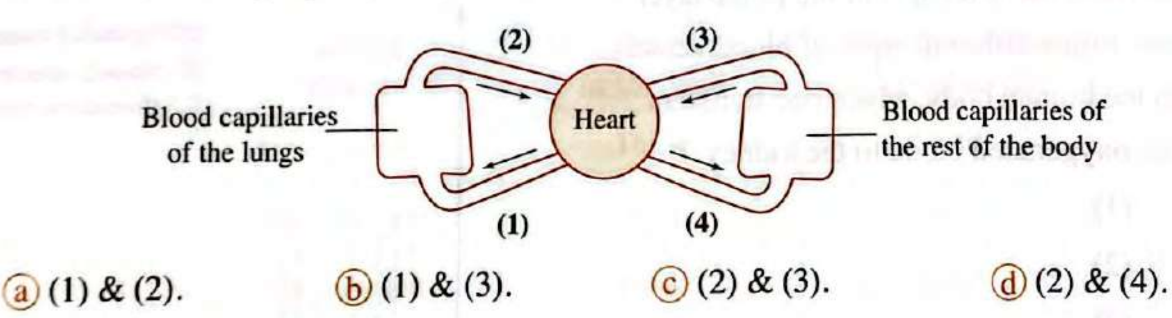
14 Which of the following groups represents the blood vessels carrying oxygenated blood ?
ⓐ Aorta – Pulmonary artery – Renal artery.
ⓑ Aorta – Pulmonary vein – Renal artery.
ⓒ Venae cavae – Pulmonary artery – Renal vein.
ⓓ Venae cavae – Pulmonary vein – Renal vein.

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15 ✱ Which of the following statements is correct ?
ⓐ The contraction of the right side of heart is delayed than that of the left side.
ⓑ The contraction of the left side of heart is delayed than that of the right side.
ⓒ The contraction of the upper side of heart is delayed than that of the lower side.
ⓓ The contraction of the lower side of heart is delayed than that of the upper side.

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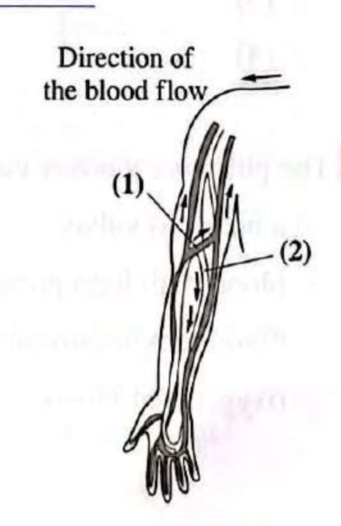
16 ✱ In the following figure, which blood vessels carry deoxygenated blood ?



ⓐ (1) & (2). ⓑ (1) & (3). ⓒ (2) & (3). ⓓ (2) & (4).

---

17 ✱ In the opposite figure :



(1) Which of the following statements <u>**doesn't**</u> agree with structure no. (1) ?
ⓐ Its wall contains valves.
ⓑ It carries blood to the heart.
ⓒ It is not a pulsating blood vessel.
ⓓ It carries oxygenated blood.

(2) Which of the following **doesn't** agree with the characteristics of structure no. (2) ?

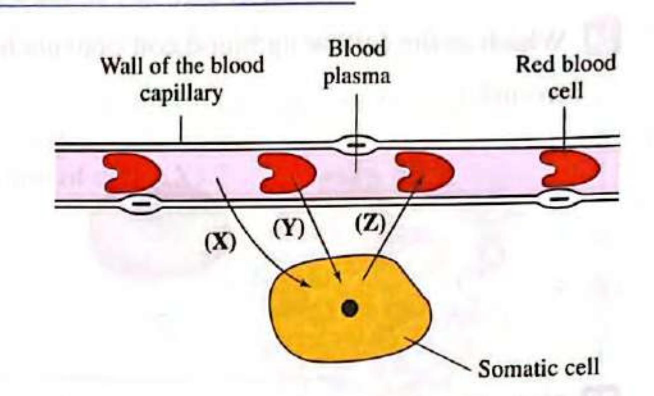
ⓐ It carries oxygenated blood.

ⓑ The thickness of its wall is lower than no. (1).

ⓒ It carries blood away from the heart.

ⓓ The blood pressure in it is higher than that in no. (1).

18 ✻ In the opposite figure, what do symbols (X), (Y) and (Z) represent respectively ?



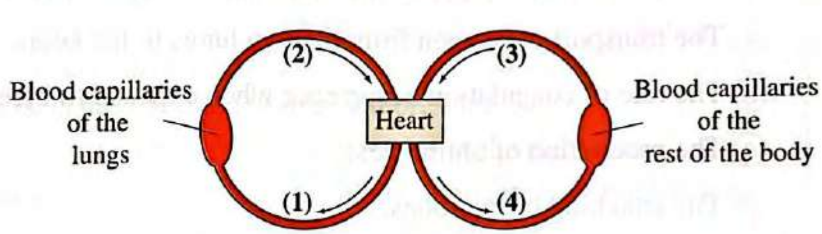
ⓐ Oxygen / Carbon dioxide / Glucose.

ⓑ Glucose / Oxygen / Carbon dioxide.

ⓒ Carbon dioxide / Oxygen / Glucose.

ⓓ Oxygen / Glucose / Carbon dioxide.

19 ✻ In the following figure, which of the following blood vessels carry blood at low pressures ?



ⓐ (1) & (2).

ⓑ (1) & (4).

ⓒ (2) & (3).

ⓓ (2) & (4).

Blood

20 Which of the following substances may be present dissolved in the blood plasma ?

ⓐ Glucose, hormones and urea.

ⓑ CO_2 gas, O_2 gas and haemoglobin.

ⓒ CO_2 gas, haemoglobin and glucose.

ⓓ O_2 gas, urea and starch.

21 In which of the following places does haemoglobin change into oxyhaemoglobin ?

ⓐ Heart.

ⓑ Two kidneys.

ⓒ Liver.

ⓓ Two lungs.

22 Which of the following **doesn't/don't** have an immunization role in the human body ?

ⓐ Red blood corpuscles.

ⓑ White blood corpuscles.

ⓒ Blood platelets.

ⓓ Blood plasma.

23 To which of the following is the patient with liver fibrosis exposed ?

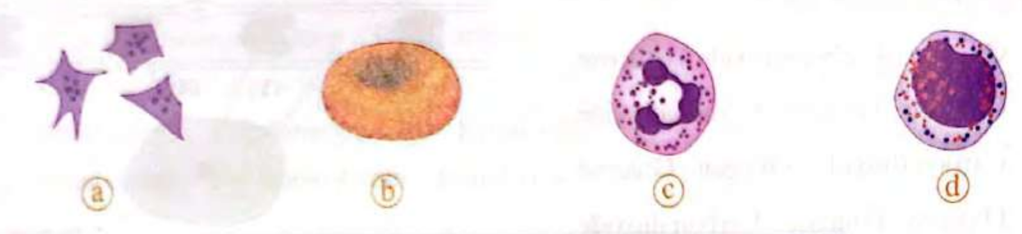
ⓐ The decrease in vitamin (K).

ⓑ The blood liquidity (haemophilia).

ⓒ The increase in the formation of thrombin substance.

ⓓ The increase in the percentage of blood proteins.

24 Which of the following blood components has an important role in healing a superficial wound ?



25 If the blood of a person contains a number of blood platelets less than the normal level, which of the following processes will be affected ?

ⓐ The transport of oxygen from the two lungs to the heart.

ⓑ The rate of coagulation occurrence when exposed to bleeding.

ⓒ The production of antibodies.

ⓓ The attacking of microbes.

26 Which of the following is present in the plasma during the absence of blood clotting factors from a blood sample ?

ⓐ Thromboplastin. ⓑ Thrombin. ⓒ Fibrin. ⓓ Fibrinogen.

27 To clot blood quickly when a wound is found, it's advised to eat food that contains ....

ⓐ lipids. ⓑ carbohydrates. ⓒ vitamin (K). ⓓ vitamin (A).

28 Why does the increase in the percentage of some types of lipids in blood represent a risk of forming clots inside the blood vessels ?

ⓐ Because they increase the speed of blood inside the vessel.

ⓑ Because they prevent the secretion of heparin substance.

ⓒ Because they stimulate the conversion of fibrin into fibrinogen.

ⓓ Because they slow down the movement of blood in normal manner.

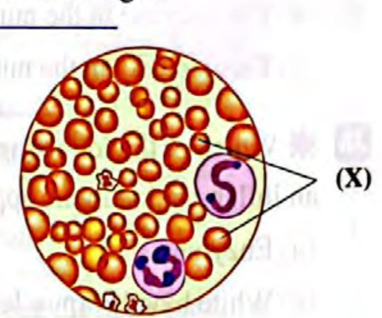
29 Which of the following leads to the formation of a blood clot ?

ⓐ Shortage of vitamin (K).
ⓑ Shortage of calcium ions in blood.
ⓒ Malformation of thrombin substance in its appropriate time.
ⓓ Breaking down of blood platelets inside the blood vessel.

30 Which of the following substances are secreted by the liver in blood ?

ⓐ Fibrin and heparin.
ⓑ Prothrombin and thromboplastin.
ⓒ Prothrombin and heparin.
ⓓ Fibrin and fibrinogen.

31 From the opposite figure, what is the function of cells (X) ?



ⓐ Transferring oxygen.
ⓑ Transferring hormones.
ⓒ Blood coagulation.
ⓓ Resistance against diseases.

32 Which of the following proteins is **not** present in the blood plasma normally ?

ⓐ Albumin.
ⓑ Globulin.
ⓒ Fibrinogen.
ⓓ Fibrin.

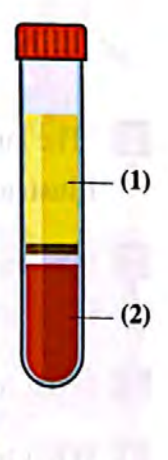
33 Which of the following vessels has the maximum blood pressure ?

ⓐ Veins of the left arm.
ⓑ Arteries of the right arm.
ⓒ Renal nourishing arteries.
ⓓ Nourishing artery of the left leg.

34 Which of the following **isn't** effective on the blood pressure ?

ⓐ The diameter of the blood vessels.
ⓑ The number of WBCs.
ⓒ The systolic pressure of the two ventricles.
ⓓ The volume of the blood returning back to the heart with each pulse.

35 * The opposite figure illustrates the separation of a blood sample components of a normal person by using centrifugation, which of the following represents the blood components in no. (1) and (2) respectively ?



	(1)	(2)
ⓐ	Red and white blood corpuscles	Plasma and blood platelets
ⓑ	White blood corpuscles and blood platelets	Red blood corpuscles and plasma
ⓒ	Plasma	Red and white blood corpuscles and blood platelets
ⓓ	Blood platelets	Red and white blood corpuscles and plasma

36 ✱ How far are these statements "the blood contains various group of soluble proteins in its normal state", "and some insoluble proteins are formed in the abnormal state" correct ?

ⓐ The first statement is correct and the second statement is wrong.

ⓑ The first statement is wrong and the second statement is correct.

ⓒ The two statements are correct.

ⓓ The two statements are wrong.

37 ✱ Which of the following characterizes the blood of the heights inhabitants ?

ⓐ The increase in the number of RBCs. ⓑ The increase in the number of WBCs.

ⓒ The decrease in the number of RBCs. ⓓ The decrease in the number of WBCs.

38 ✱ Which of the following their number increases in blood, when a human suffers from an inflammation in the appendix ?

ⓐ Enzymes. ⓑ Blood platelets.

ⓒ White blood corpuscles. ⓓ Red blood corpuscles.

39 ✱ The opposite test tube contains a centrifuged blood sample, in your opinion the owner of this sample ....

ⓐ drinks too much water.

ⓑ loses too much water.

ⓒ suffers from anemia.

ⓓ is a healthy person.

40 ✱ What is the normal volume of water in the blood of a person who has 6 liters of blood ?

ⓐ 2.4 L ⓑ 2.7 L ⓒ 2.9 L ⓓ 3.2 L

Second Miscellaneous Questions

1 "The human body contains a group of internal membranes that differ in their functions". **Illustrate this by using two different examples in the light of your study.**

2 "The human heart contains valves with specific fixed function". **How far is this statement correct ? With explanation.**

3 **What happens in case of :** the absence of valves from the heart muscle ?

4 **What happens in case of :** the absence of sino-atrial node ?

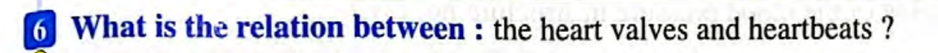
5 **The following figure shows a diagrammatic figure for the human heart :**

(a) **Mention the names** of each of the valves (A), (B), (C) and (D).

(b) **What** is the type of blood that is present in the structures from no. (1) : (4) "oxygenated or deoxygenated", "under low pressure or high pressure" ?

(c) **What is the difference between** the structures no. (6) and (7) ?

(d) **Describe** how the structure no. (5) can be stimulated which causes an increase in the rate of heartbeats.

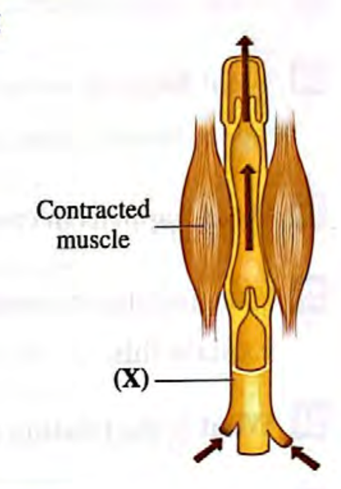


6 **What is the relation between :** the heart valves and heartbeats ?

7 **Give reason for :** the presence of arteries usually buried among the body muscles.

8 **Give reason for :** the artery wall is thicker than the vein wall.

9 **The opposite figure illustrates the blood flow in a human leg during walking :**



(a) **What** does label (X) represent ? **Mention two reasons for your answer.**

(b) **Illustrate how** the blood flows, when the two muscles contract.

(c) **How** does the contraction of the two muscles affect the rate of heartbeats ? **Explain your answer.**

(d) **What** are the factors upon which the blood flow in this direction depends ?

10 **Give reason for :** the bleeding from artery is more dangerous than the bleeding from vein.

11 **The opposite figures represent two types of blood vessels :**

(a) **What** is the type of vessel (X) and vessel (Y) ?

(b) **In which** layer are the elastic fibers present ? **And in which** vessel their presence is rare ?


(X)


(Y)

12 **Give reason for :** although the blood pressure is low in veins, blood returns back to the heart through them.

13 **What is the difference between :** pulmonary vein and pulmonary artery ?

14 **What happens in case of :** the absence of valves inside the cavity of some veins ?

15 **The following figure represents a network of the blood vessels in the body :**

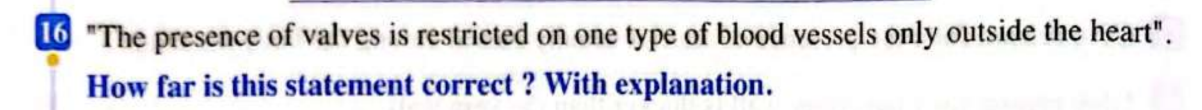
(a) **What is the functional suitability** of structure no. (2) ?

(b) **Where** is structure no. (2) in the human body ?

(c) **Which of these structures contains :**

1. The highest percentage of oxygen.
2. Valves that control the passage of blood.

(d) **What** is the value of the blood pressure in structure no. (3) ?



16 "The presence of valves is restricted on one type of blood vessels only outside the heart". **How far is this statement correct ? With explanation.**

17 **What is the similarity between :** root hairs and blood capillaries ?

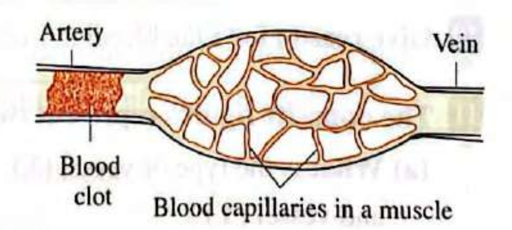
18 **What happens in case of :** decreasing the level of haemoglobin that is present in the red blood corpuscles than the normal range ?

19 **What happens in case of :** the shortage of iron element in the human food ?

20 "The role of prothrombin differs from that of fibrinogen, when human exposed to a wound". **Explain this.**

21 **What is the relation between :** the blood clotting and vitamin (K) ?

22 The opposite figure illustrates the formation of a blood clot inside an artery of a muscle, **suggest** the name of one substance that is useful and doesn't reach the blood capillaries in the muscle.



23 **Explain :** the nature of fibrin protein suits its function.

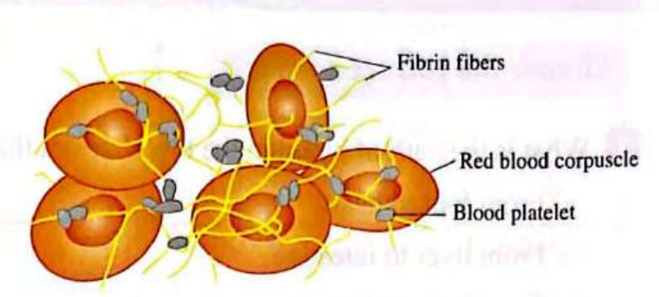
24 **Explain :** fibrin filaments play an important role in maintaining the human's life.



25 **What is the relation between :** liver and the formation of blood clot ?

---

26 **The following figure shows a blood clot in a cut blood vessel :**



(a) **Mention** the role of fibrin fibers in the formation of blood clot.

(b) **Suggest** two functions for the blood clot.

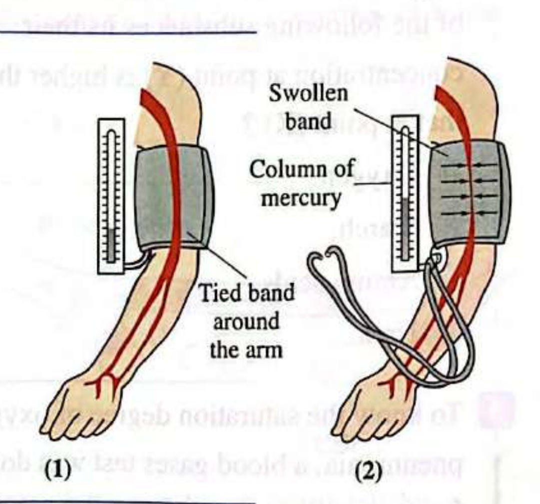
(c) **What** are the most important enzymes needed to form the clot ? **And what** is their role ?

---

27 **Explain :** the human blood pressure decreases in case of the occurrence of bleeding.

---

28 **The two opposite figures illustrate the mechanism of measuring the blood pressure in human :**



Which one of them represents the systolic blood pressure ? **And which** one of them represents the diastolic blood pressure ? **Giving reason.**

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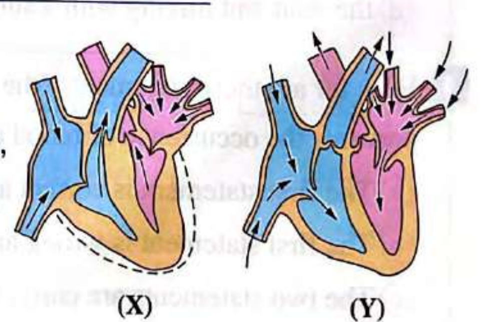
29 "The maximum blood pressure is in the veins that are close to the heart, on the relaxation of ventricles". **How far is this statement correct ? With explanation.**

---

30 **What does it mean when saying that** "your blood pressure is 110 / 70 mm Hg" ?

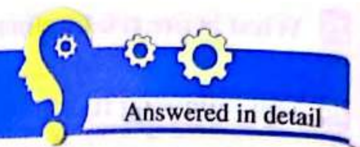
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31 **From the two opposite figures :**



(a) **Which** one of the two figures (X) or (Y) represents the maximum value of blood pressure, **and which** one of them represents the minimum value ?

(b) **What** is the sound produced by the heart in each of the two figures ?

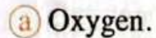


Questions that measure **high levels of thinking**

Answered in detail

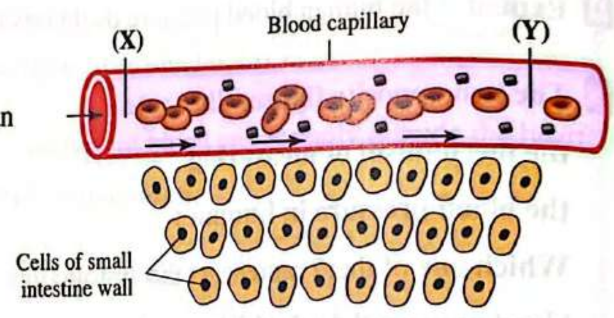
Choose the correct answer :

1 What is the path of blood in the blood vessel that is illustrated in the following figure ?



(a) From foot to heart.
(b) From liver to intestine.
(c) From heart to kidney.
(d) From heart to the two lungs.

2 In the opposite figure, which of the following substances its/their concentration at point (Y) is higher than that at point (X) ?



(a) Oxygen.
(b) Starch.
(c) Amino acids.
(d) Urea.

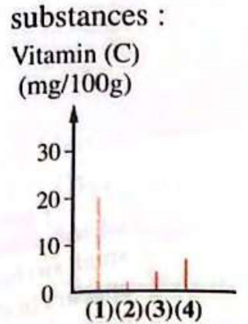
3 To know the saturation degree of oxygen accurately for a patient who suffers from severe pneumonia, a blood gases test was done where the blood sample should be taken from ....

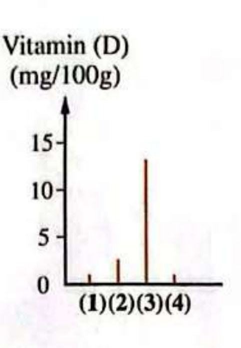
(a) the artery and mixing with heparin substance.
(b) the vein and mixing with heparin substance.
(c) the artery and mixing with a substance that helps in coagulation.
(d) the vein and mixing with a substance that helps in coagulation.

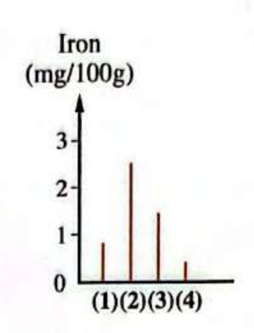
4 How far are these statements "the liver helps in the formation of blood clot", "the liver prevents the occurrence of blood clot" correct ?

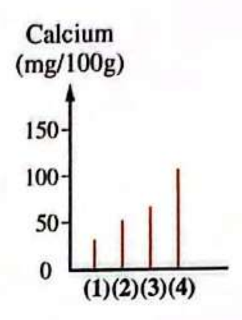
(a) The first statement is correct and the second statement is wrong.
(b) The first statement is wrong and the second statement is correct.
(c) The two statements are correct.
(d) The two statements are wrong.

5 The following graphs represent the amount of vitamins and minerals in four food substances :









(1) Which of the following food substances is considered the best source for transporting oxygen by the blood ?

ⓐ (1). ⓑ (2). ⓒ (3). ⓓ (4).

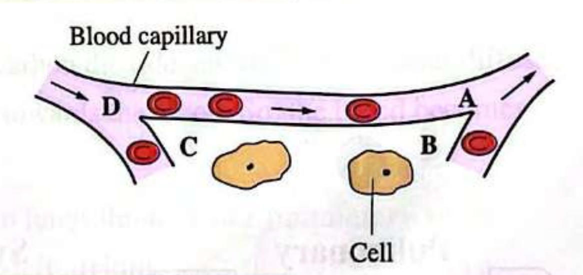
(2) What is the food substance that is rich in a necessary element for protecting the blood from bleeding ?

ⓐ (4). ⓑ (3). ⓒ (2). ⓓ (1).

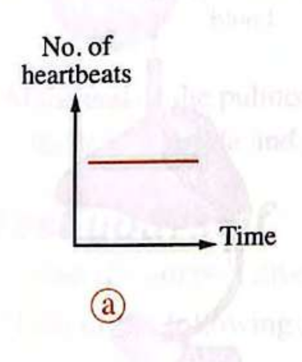
6 In the opposite figure, at which point the blood pressure is maximum ?

ⓐ (A). ⓑ (B).

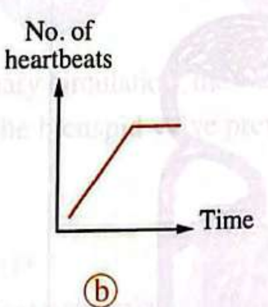
ⓒ (C). ⓓ (D).



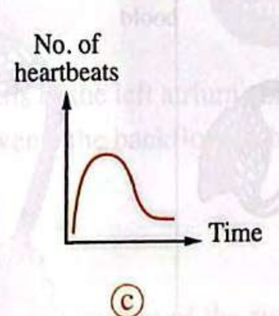
7 Which of the following graphs illustrates the change in the number of heartbeats by passing time after waking up ?



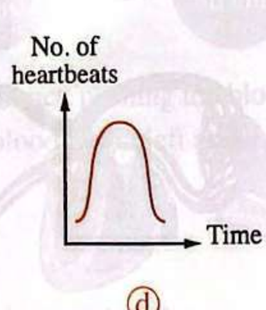
ⓐ



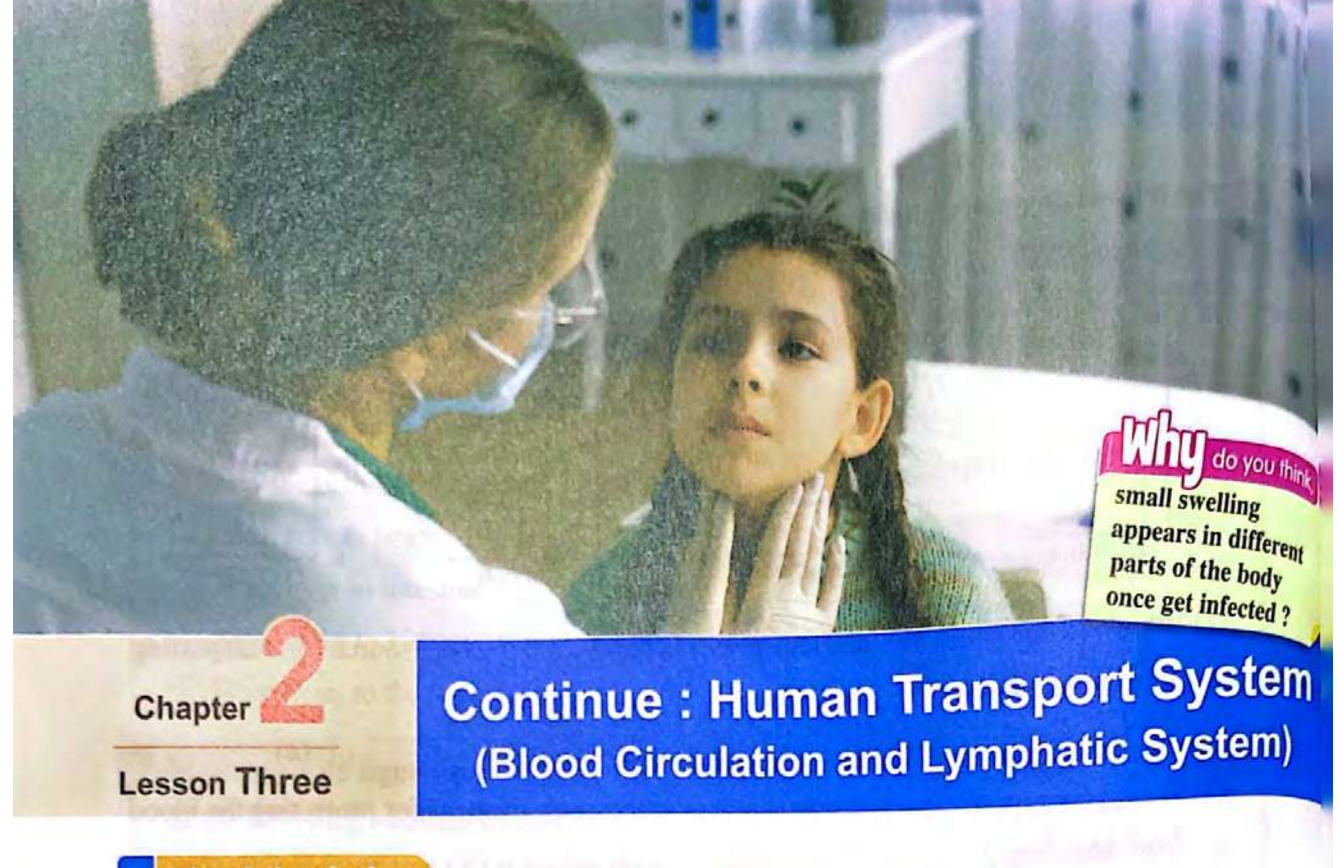
ⓑ



ⓒ



ⓓ



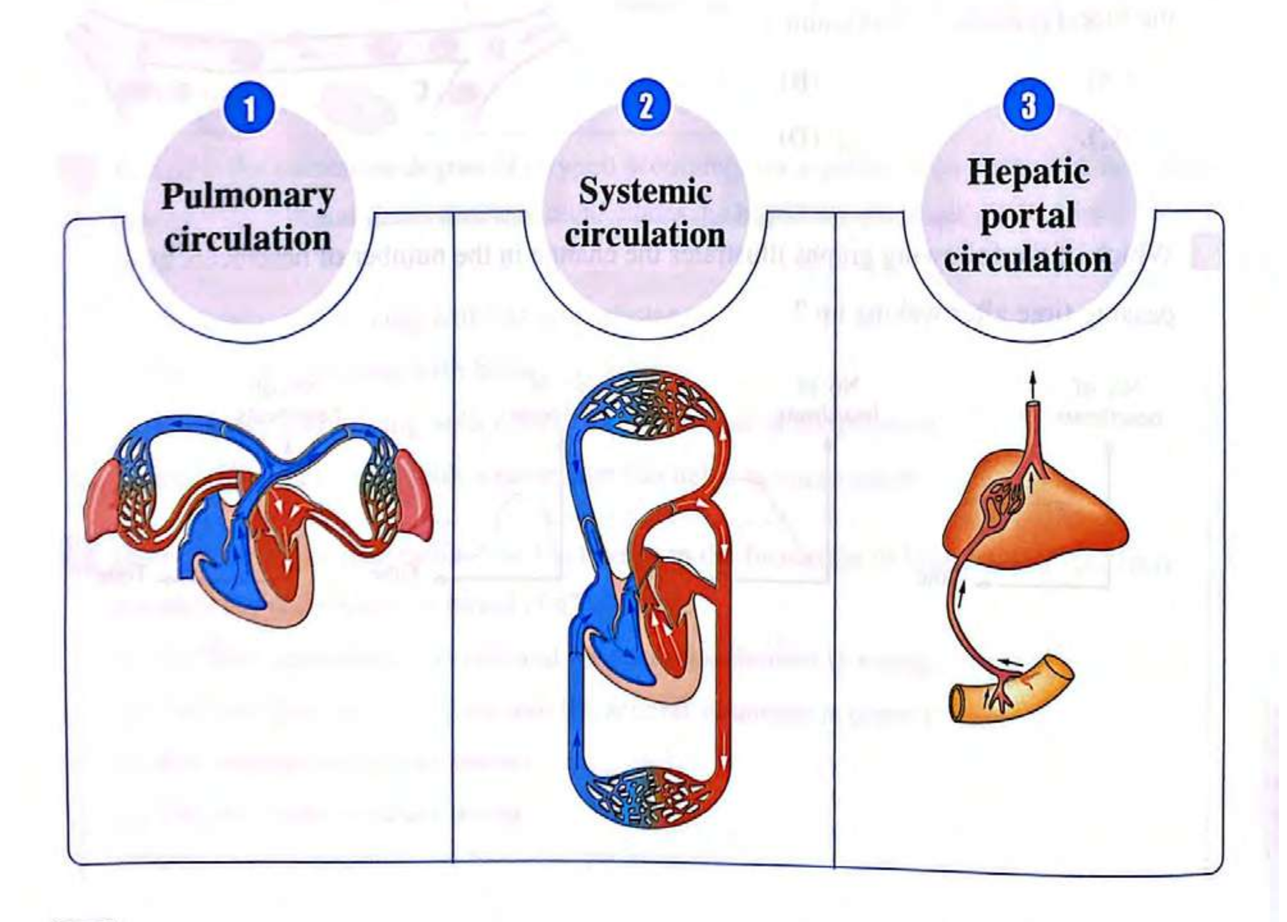
Chapter 2

Lesson Three

Continue : Human Transport System (Blood Circulation and Lymphatic System)

Blood circulation

- **Blood circulation in human can be divided into three main pathways which are :**

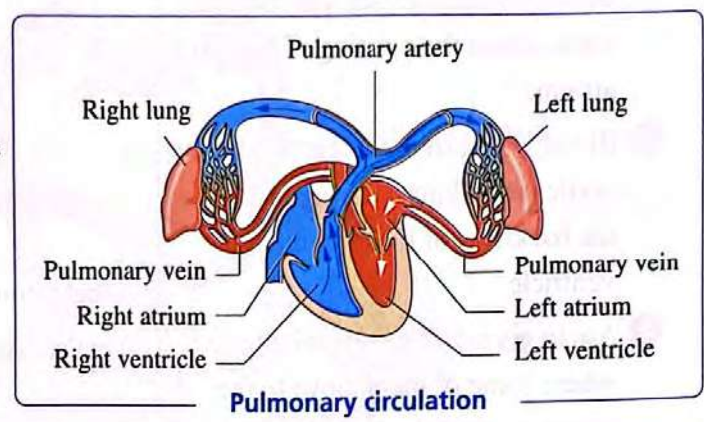


First Pulmonary circulation



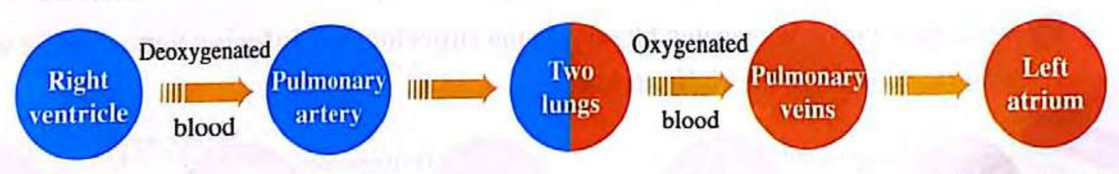
- It starts from the right ventricle and ends in the left atrium, **and it takes place as follows :**

1. When the **right ventricle** contracts, the tricuspid valve closes the opening of the right atrium.
2. The **deoxygenated blood** rushes through the **pulmonary artery** and the pulmonary (semi-lunar) valve prevents the backflow of blood to the right ventricle.



Pulmonary circulation

3. The pulmonary artery gives rise to two branches (a branch to each **lung**), where each branch of them branches in its tissues to form several arterioles which end with blood capillaries spread around the alveoli.
4. The exchange of gases takes place, where carbon dioxide gas and water vapour diffuse from the blood, and oxygen gas will move towards the blood. So, the blood becomes **oxygenated**.
5. The **oxygenated blood** returns from the two lungs through **four pulmonary veins** (two veins from each lung) to open into the **left atrium**.



- At the end of the pulmonary circulation, the walls of the left atrium contract, pushing the blood to the left ventricle and the bicuspid valve prevents the backflow of blood to the left atrium.

1 *Test yourself*



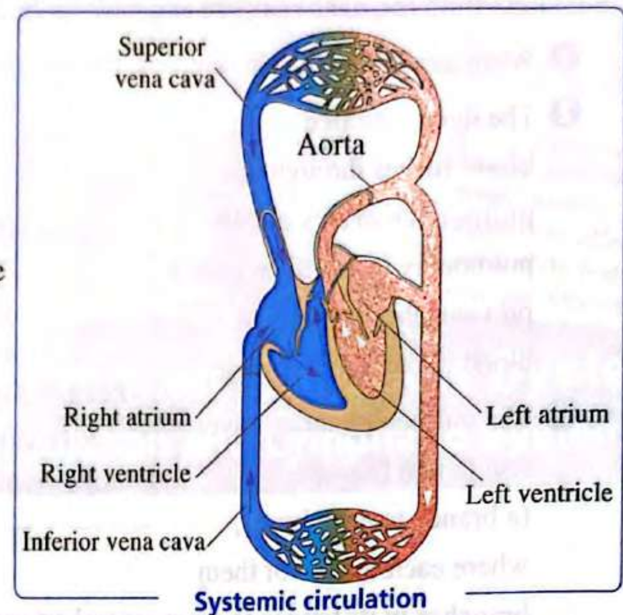
Choose the correct answer :

Which of the following is synchronized with the relaxation of the right ventricle ?

(a) The closure of the mitral valve.
(b) The opening of the bicuspid valve.
(c) The closure of the tricuspid valve.
(d) The opening of the pulmonary valve.

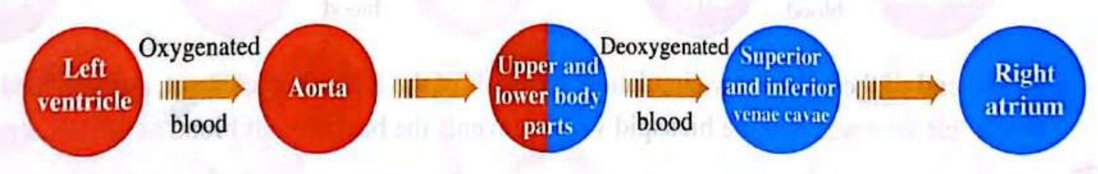
Second Systemic circulation

- It starts from the left ventricle and ends in the right atrium, **and it takes place as follows :**



Systemic circulation

1. The **left ventricle** contracts after being filled with the **oxygenated blood**, so that the bicuspid (mitral) valve closes the opening of the left atrium.
2. Blood will rush to the **aorta**, and the aortic (semi-lunar) valve prevents the backflow of blood to the left ventricle.
3. **Aorta** gives rise to several arteries, where some of them move to the **upper part of the body**, while the others go to the **lower part**.
   Then, arteries branch to form smaller and smaller arterioles which end by the blood capillaries that spread through the tissues among the cells, transporting oxygen, water and dissolved food substances from blood to them.
4. Products of catabolism, such as carbon dioxide gas (resulting from the oxidation of fats and sugar) diffuse through the walls of blood capillaries and reach the blood, changing its colour from light red to dark red **(deoxygenated blood)**.
5. Blood capillaries gather to give rise to a larger and larger blood vessels which are "veins".
6. Veins pour the deoxygenated blood into the **superior and inferior venae cavae** which pour the blood into the **right atrium**.

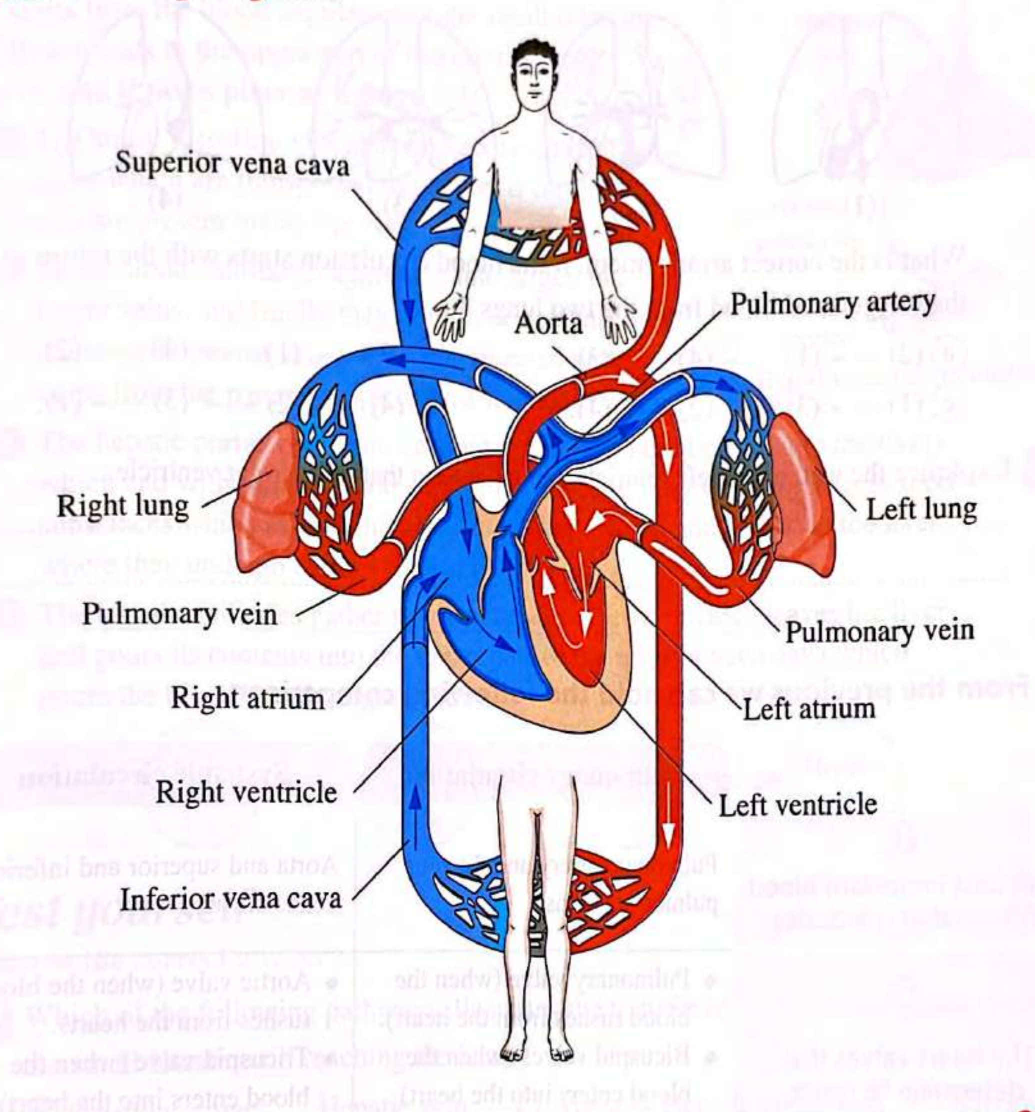


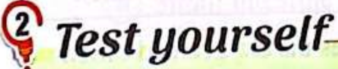
- At the end of the systemic circulation, the walls of the right atrium contract (when it is filled with blood), pushing the deoxygenated blood to the right ventricle and the tricuspid valve prevents the return back of blood to the right atrium.

Note

The contraction of the right side of heart occurs at the same time of the left side contraction. Therefore, pumping the deoxygenated blood from the right ventricle and pumping the oxygenated blood from the left ventricle take place at the same time.

We can summarize the plumonary and systemic circulations together in the following diagram :







1 Choose the correct answer :

(1) Which of the following blood vessels is <u>not</u> connected with the right side of the heart ?

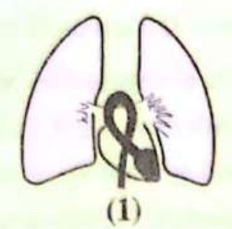
ⓐ Superior vena cava.

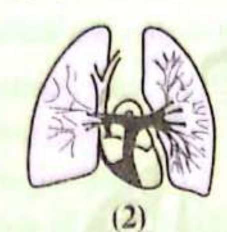
ⓑ Inferior vena cava.

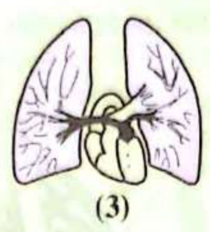
ⓒ Pulmonary vein.

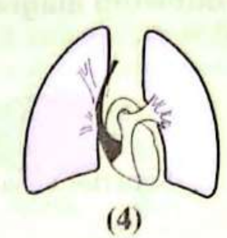
ⓓ Pulmonary artery.

(2) Study the following figures, then determine :


(1)


(2)


(3)


(4)

What is the correct arrangement, if the blood circulation starts with the return of the oxygenated blood from the two lungs ?

ⓐ (2) → (1) → (4) → (3).
ⓑ (3) → (1) → (4) → (2).
ⓒ (1) → (3) → (2) → (4).
ⓓ (4) → (2) → (3) → (1).

2 **Explain :** the wall of the left ventricle is thicker than that of the right ventricle.

....

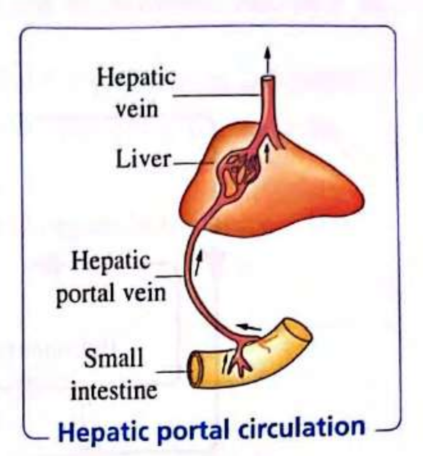
....

From the previous we can hold the following comparison :

	Pulmonary circulation	Systemic circulation
1 The most important blood vessels that it includes	Pulmonary artery and the four pulmonary veins.	Aorta and superior and inferior venae cavae.
2 The heart valves that determine its route	• Pulmonary valve (when the blood rushes from the heart). • Bicuspid valves (when the blood enters into the heart).	• Aortic valve (when the blood rushes from the heart). • Tricuspid valve (when the blood enters into the heart).
3 The blood that is carried outside the heart	It carries the deoxygenated blood from the right ventricle to the two lungs through the pulmonary artery.	It carries the oxygenated blood from the left ventricle to all the body parts through aorta.
4 The blood that is carried inside the heart	It carries the oxygenated blood from the two lungs to the left atrium through the four pulmonary veins.	It carries the deoxygenated blood from the body to the right atrium through the superior and inferior venae cavae.
5 Its importance	Helping the blood to get rid of carbon dioxide and supplying it with oxygen.	Supplying the body cells with oxygen and dissolved food substances.

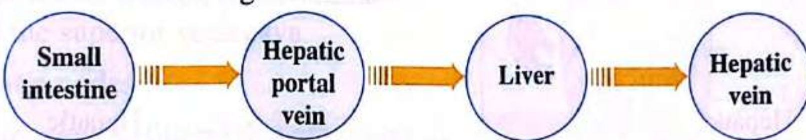
Third Hepatic portal circulation

- It starts from the blood capillaries of the small intestine villi and ends in the upper part of the inferior vena cava, **and it takes place as follows :**



Hepatic portal circulation

1. The **small intestine villi** absorb glucose and amino acids which are transported to the blood capillaries that are present inside the villi.
2. These blood capillaries aggregate into larger and larger veins, and finally they pour their contents into the **hepatic portal vein** which is connected with veins from the pancreas, spleen and stomach.
3. The hepatic portal vein branches into **venules** (when it enters into the liver) which end with minute blood capillaries, through their walls the excess food substances which exceed the body needs are filtered and passed to the liver where they undergo certain changes.
4. The blood capillaries gather to form the **hepatic vein** which leaves the liver and pours its contents into the upper part of the inferior vena cava which pours the blood into the right atrium.



3 *Test yourself*

Answered

Choose the correct answer :

1 Which of the following pathways illustrates the transfer of a glucose molecule from the small intestine till reaching the heart ?

(a) Small intestine → Hepatic vein → Liver → Hepatic portal vein → Superior vena cava.

(b) Small intestine → Hepatic portal vein → Liver → Hepatic vein → Superior vena cava.

(c) Small intestine → Hepatic vein → Liver → Hepatic portal vein → Inferior vena cava.

(d) Small intestine → Hepatic portal vein → Liver → Hepatic vein → Inferior vena cava.

2 Which of the following organ(s) receive(s) blood from two main blood vessels, then the blood comes out from it(them) through one blood vessel ?

(a) Heart. (b) Liver. (c) Kidney. (d) Two lungs.

We can summarize the blood circulation in the following diagram :

Head and arms
Lungs
Pulmonary artery
Aorta
Pulmonary veins
Vena cava
Left atrium
Right atrium
Right ventricle
Left ventricle
Hepatic vein
Liver
Hepatic artery
Hepatic portal vein
Digestive system
Gonads, legs and kidneys

For illustration only

There is a fourth blood circulation that is called the **cardiac circulation** which includes the movement or the flow of blood inside the four chambers of heart, according to the contraction and relaxation of the heart chambers.



Lymphatic system

- The lymphatic system is considered the immune system of the body, due to its defensive ability, where it produces the antibodies that are responsible for providing the body its immunity.
- The **spleen** is considered one of the most important lymphatic organs in the body.
- **The lymphatic system consists of :**

1 Lymph :

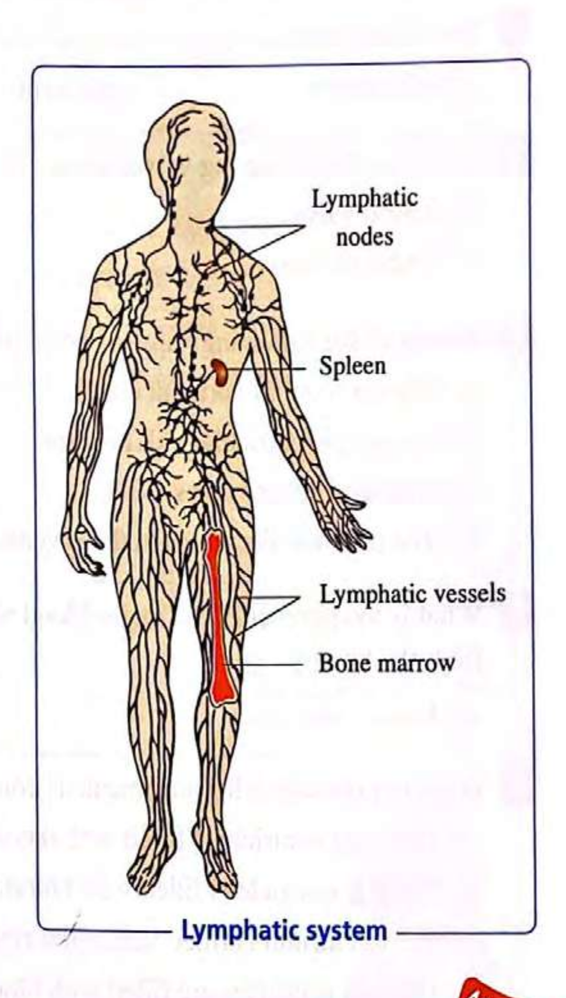
- It is a fluid that is filtered from the blood plasma during its passage through the blood capillaries.
- It contains nearly most of the plasma constituents, in addition to a large number of leucocytes (WBCs).

2 Lymphatic capillaries (vessels) :

They work on collecting the lymph to return it into the circulatory system through the superior vena cava.

3 Lymphatic nodes :

- They are sieves (filters) that are found at certain points along the lymphatic vessels through which the lymph passes.
- They trap and destroy the microbes by the white blood cells produced by them.



Lymphatic system

4 *Test yourself*

Answered

Choose the correct answer :

1 Which of the following is/are **not** from the components of lymph ?

ⓐ Amino acids. ⓑ Antibodies.
ⓒ Prothrombin. ⓓ Sodium salts.

2 Which of the heart chambers is responsible for receiving the lymph ?

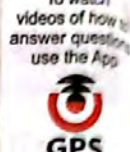
ⓐ Right atrium. ⓑ Right ventricle.
ⓒ Left atrium. ⓓ Left ventricle.

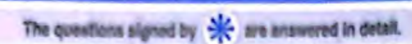
Chapter 2

Questions on Lesson Three

Continue : Human Transport System

(Blood Circulation and Lymphatic System)







Apply   Analyze



Interactive test

First Multiple Choice Questions

1 The blood that reaches the brain cells leaves the heart from the ....

ⓐ left atrium. ⓑ right atrium. ⓒ left ventricle. ⓓ right ventricle.

2 Which of the following valves allows the passage of blood under high pressure ?

ⓐ Mitral valve. ⓑ Aortic valve.

ⓒ Tricuspid valve. ⓓ Bicuspid valve.

3 Which of the following happens when the two ventricles contract ?

ⓐ The pressure of aorta increases.

ⓑ The atrio-ventricular valves open.

ⓒ The semi-lunar valves close.

ⓓ The pressure decreases in these ventricles.

4 What is the number of the major blood vessels that carry oxygenated blood and come out from the heart ?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

5 Which of the following statements is correct ?

ⓐ The right ventricle is filled with blood before the left ventricle.

ⓑ The left ventricle is filled with blood before the right ventricle.

ⓒ The left atrium is filled before the right atrium.

ⓓ The two ventricles are filled with blood at the same time.

6 Which of the following happens at the ventricles relaxation ?

ⓐ Opening of semi-lunar valves.

ⓑ Opening of atrio-ventricular valves.

ⓒ Pressure of aorta becomes higher than that of the two ventricles.

ⓓ Pressure of left atrium becomes higher than that of right atrium.

7 How many times does the blood pass through the heart during its passage from the two kidneys till reaching the aorta ?

ⓐ One time. ⓑ Two times. ⓒ Four times. ⓓ More than four times.

8 When the blood arrives to the heart through the venae cavae, through which of the following blood vessels will the blood pass after that ?

ⓐ Pulmonary vein. ⓑ Pulmonary artery.
ⓒ Hepatic vein. ⓓ Hepatic portal vein.

9 Which of the following blood vessels has the highest blood pressure ?

ⓐ Pulmonary artery. ⓑ Superior vena cava.
ⓒ Aorta. ⓓ Inferior vena cava.

10 Which of the following occur when the blood passes from the right ventricle to the two lungs ?

ⓐ The closure of mitral valve and the opening of tricuspid valve.
ⓑ The opening of mitral valve and the closure of tricuspid valve.
ⓒ The opening of semi-lunar valve and the closure of tricuspid valve.
ⓓ The closure of semi-lunar valve and the opening of tricuspid valve.

11 In the opposite diagram :

Which of the following blood vessels contain the highest percentage of oxygen gas ?

ⓐ (1) & (2). ⓑ (2) & (3).
ⓒ (3) & (4). ⓓ (4) & (1).

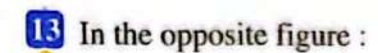
12 From the opposite figure :

(1) Which of the following represents the function of structure (X) ?

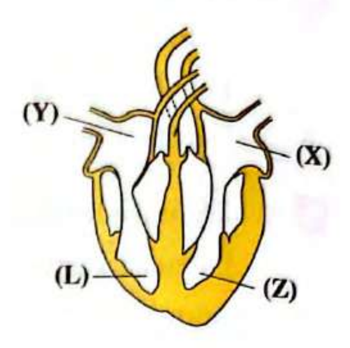
ⓐ Transporting the oxygenated blood from the heart to all the body parts.
ⓑ Transporting the oxygenated blood from the two lungs to the heart.
ⓒ Transporting the deoxygenated blood from the heart to the two lungs.
ⓓ Returning the deoxygenated blood from all the body parts to the heart.

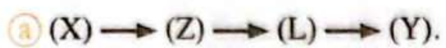
(2) Which of the following blood vessels is connected to the heart, but it is not observed in the figure ?

ⓐ Aorta. ⓑ Superior vena cava.
ⓒ Pulmonary artery. ⓓ Inferior vena cava.

13 In the opposite figure :

Which of the following pathways shows the transfer of blood from the two lungs to the heart, then its pumping to the body parts and its return back to the heart again ?




ⓐ (X) ⟶ (Z) ⟶ (L) ⟶ (Y).

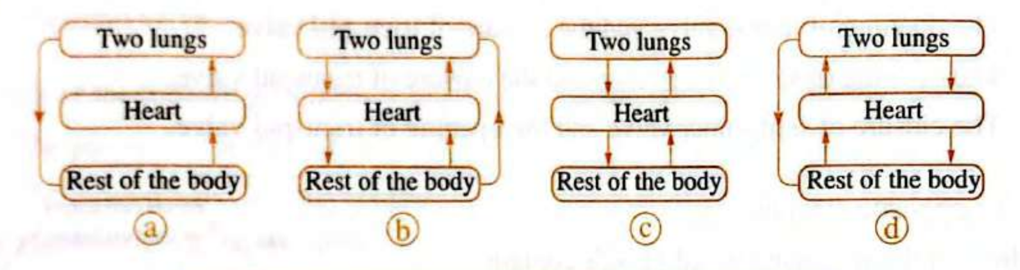
ⓑ (X) ⟶ (Z) ⟶ (Y) ⟶ (L).

ⓒ (Y) ⟶ (L) ⟶ (X) ⟶ (Z).

ⓓ (Y) ⟶ (L) ⟶ (Z) ⟶ (X).

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14 Which of the following diagrams illustrates the blood circulation in the human body ?



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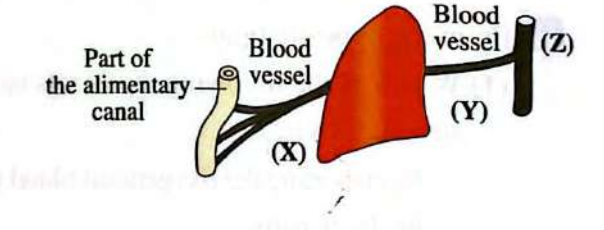
15 What are the main blood vessels that carry blood from and to the head respectively ?

ⓐ Superior vena cava /Aorta. ⓑ Superior vena cava / Inferior vena cave.

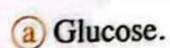
ⓒ Inferior vena cava / Aorta. ⓓ Aorta / Superior vena cava.

---

16 In the opposite figure :



(1) Which of the following is transported in blood vessel (X) ?


ⓐ Glucose. ⓑ Bile juice.

ⓒ Glycogen. ⓓ Urea.

(2) The blood that flows in blood vessel (Y) contains a high level of ....

ⓐ haemoglobin. ⓑ carbo-aminohaemoglobin.

ⓒ oxyhaemoglobin. ⓓ fatty acids.

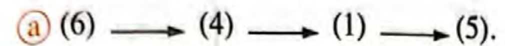
(3) What does blood vessel (Z) represent ?

ⓐ The upper part of superior vena cava. ⓑ The lower part of superior vena cava.

ⓒ The upper part of inferior vena cava. ⓓ The lower part of inferior vena cava.

17 In the opposite diagram :

Through which of the following pathways the blood must pass to be transferred from blood vessel no. (6) to blood vessel no. (5) ?

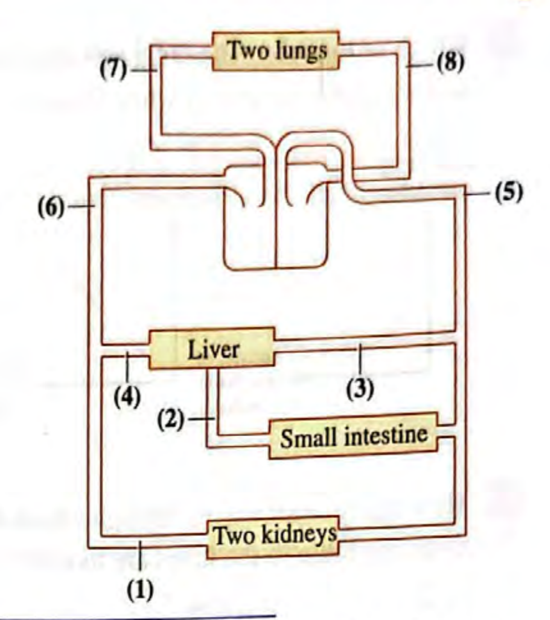


ⓐ (6) ⟶ (4) ⟶ (1) ⟶ (5).

ⓑ (6) ⟶ (4) ⟶ (3) ⟶ (5).

ⓒ (6) ⟶ (7) ⟶ (8) ⟶ (5).

ⓓ (6) ⟶ (2) ⟶ (3) ⟶ (5).



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18 Which of the following blood vessels contains the highest level of glucose after having a balanced meal ?

ⓐ Aorta. ⓑ Pulmonary artery. ⓒ Hepatic portal vein. ⓓ Hepatic vein.

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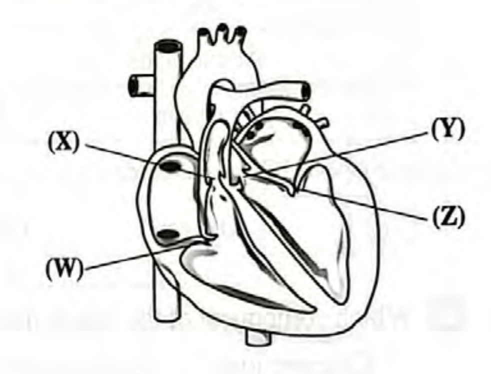
19 Using the opposite figure, which of the following pathways represents the correct arrangement for the journey of a red blood corpuscle from the brain to a leg ?

ⓐ (X) ⟶ (W) ⟶ (Z) ⟶ (Y).

ⓑ (Z) ⟶ (Y) ⟶ (X) ⟶ (W).

ⓒ (W) ⟶ (X) ⟶ (Z) ⟶ (Y).

ⓓ (Y) ⟶ (Z) ⟶ (X) ⟶ (W).



---

20 How far are these statements "the lymphatic vessels work on collecting the fatty acids and lymph","both are directed to the heart by the superior vena cava" correct ?

ⓐ The first statement is wrong and the second statement is correct.

ⓑ The first statement is correct and the second statement is wrong.

ⓒ The two statements are correct.

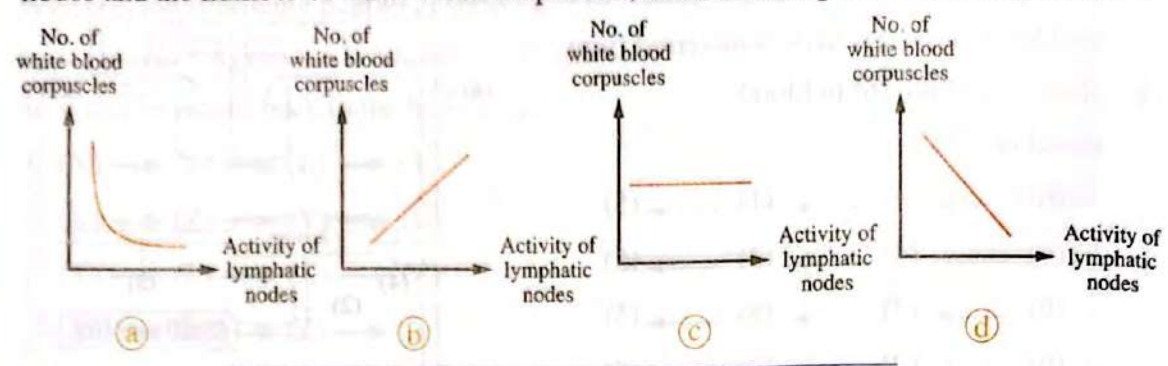
ⓓ The two statements are wrong.

---

21 Which of the following organs has a great importance for the circulatory and lymphatic systems together ?

ⓐ Villi. ⓑ Pancreas. ⓒ Bone marrow. ⓓ Lymphatic nodes.

22 Which of the following graphs illustrates the relation between the activity of lymphatic nodes and the number of white blood corpuscles, when infecting with influenza virus ?

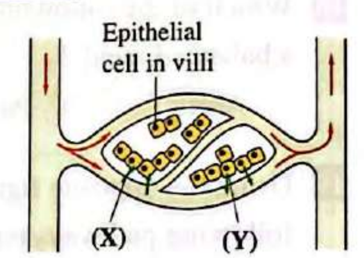


23 How many heart valves through which a red blood corpuscle passes during its journey from the brain to the lungs are found ?

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

24 From the opposite figure :

Which choice represents what passes in each of (X) and (Y) pathways ?



	(X)	(Y)
ⓐ	Amino acids	Glucose
ⓑ	Oxygen	Fatty acids
ⓒ	Carbon dioxide	Glucose
ⓓ	Oxygen	Carbon dioxide

25 Which component of the lymph fluid can be contributed in the formation of the blood clot ?

ⓐ Calcium ions. ⓑ Sodium ions. ⓒ Vitamin (D). ⓓ Vitamin (A).

26 Which of the following are present in blood and lymph ?

(1) Glucose. (2) Antibodies. (3) White blood corpuscles. (4) Globulin.

ⓐ (1), (2) and (4) only. ⓑ (1), (2) and (3) only.
ⓒ (3) and (4) only. ⓓ (1), (2), (3) and (4).

27 Which choice in the following table expresses the lymph components ?

	Water	Antibodies	Fatty acids
ⓐ	✓	✓	✓
ⓑ	✓	✓	×
ⓒ	✓	×	✓
ⓓ	✓	✓	×

28 How many major blood vessels are connected to the liver ?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

29 * Which of the following represents the correct arrangement of heart chambers from the thinner to the thicker ?

ⓐ Left ventricle / Right ventricle / Two atria.

ⓑ Right ventricle / Left ventricle / Two atria.

ⓒ Two atria / Left ventricle / Right ventricle.

ⓓ Two atria / Right ventricle / Left ventricle.

30 * What is the blood vessel where the blood passes under low pressure and contains high level of CO_2 ?

ⓐ Aorta. ⓑ Pulmonary artery.

ⓒ Vena cava. ⓓ Renal artery.

31 * What are the two valves that allow the passage of blood at the same time ?

ⓐ Bicuspid and pulmonary valves. ⓑ Pulmonary and aortic valves.

ⓒ Tricuspid and aortic valves. ⓓ Tricuspid and pulmonary valves.

32 * Which of the following valves determine the pathway of the oxygenated blood through the heart ?

ⓐ Mitral and tricuspid valves. ⓑ Mitral and aortic valves.

ⓒ Pulmonary and aortic valves. ⓓ Tricuspid and pulmonary valves.

Second Miscellaneous Questions

1 **Explain :** the blood pressure is different in each of the aorta and pulmonary artery, although both of them are arteries.

2 **Compare between :** the bicuspid valve and tricuspid valve.

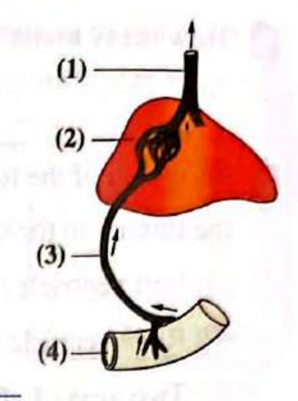
3 **Explain :** liver is called the gate of food in the body.

4 **Follow by arrows only :** the pathway of a red blood cell that is present in the blood accompanied by the absorption of the digested food, till reaching the right atrium of the heart.

5 From the opposite figure :

(a) What would happen to the excess food substances when passing through structure no. (2) ?

(b) Determine three organs whose veins pour their contents in structure no. (3).



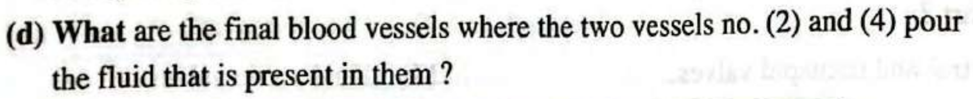
6 Follow by arrows only : the pathway of a glucose molecule, since its passage from the intestine till reaching the foot.

7 In the opposite figure :

(a) What is the name of the pathway (1) ⟶ (2) ? **And what** are the digested substances that pass through it ?

(b) What is the name of the pathway (3) ⟶ (4) ? **And what** are the digested substances that pass through it ?

(c) Which of the two blood vessels (1) or (2) contains the greatest amount of digested food during the food absorption process ?



(d) What are the final blood vessels where the two vessels no. (2) and (4) pour the fluid that is present in them ?

Heart
(4)
(2)
Liver
Lymphatic system
(1)
(3)
Ileum



8 Study the opposite figure, then answer :

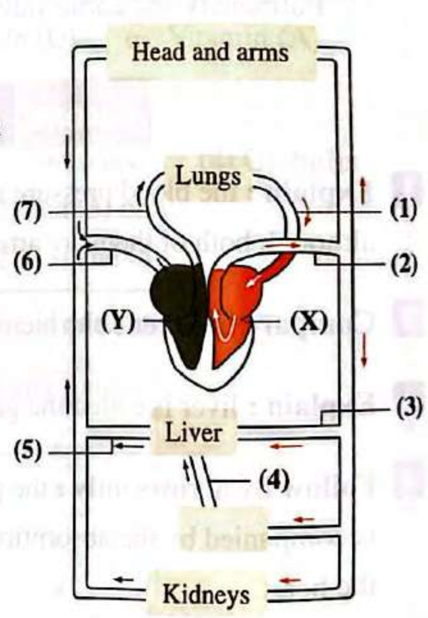
(a) Mention the number of the blood vessel that :

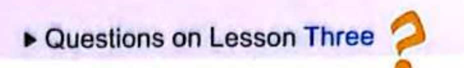
1. The blood vessels of pancreas, spleen and stomach return back to it.
2. Carries the highest level of oxyhaemoglobin.
3. Contains the highest level of amino acids after eating a meal.

(b) Which of them (X) or (Y) contains the bicuspid valve ?

(c) What is the side of heart that contains oxygenated blood (X) or (Y) ?

(d) Mention the type of blood in the two blood vessels no. (2) and (7).





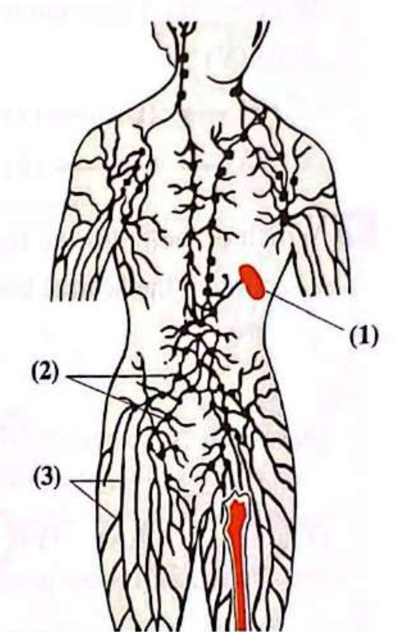
9 **What happens in case of :** the absence of lymphatic nodes that are present along the lymphatic vessels ?

---

10 **Explain :** spleen has a great importance for the circulatory and lymphatic systems.

---

11 **The following figure represents the most important defensive systems in the human body :**

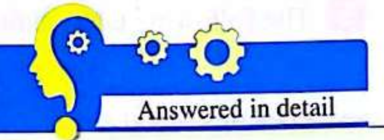


(a) **What would happen in case of** the removal of structure no. (1) ?

(b) **Illustrate the relation between** structure no. (2) and the number of white blood corpuscles, on exposure to infection.

(c) **What** is the difference between the fluid that is present in structure no. (3) and blood plasma ?

Questions that measure **high levels of thinking**



Answered in detail

Choose the correct answer :

1 Which of the following is considered the first receiver for nicotine in the smoker ?

ⓐ Left atrium. ⓑ Right atrium. ⓒ Left ventricle. ⓓ Right ventricle.

---

2 Which of the following represents the pathway of a red blood corpuscle from the heart to the left kidney ?

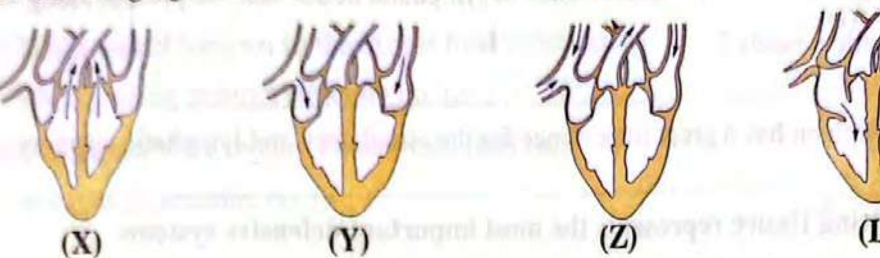
ⓐ Left ventricle → Pulmonary vein → Renal vein.

ⓑ Left ventricle → Aorta → Renal artery.

ⓒ Right ventricle → Pulmonary artery → Renal vein.

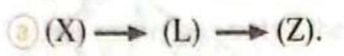
ⓓ Right ventricle → Pulmonary vein → Renal artery.

3 The following figures illustrate four different stages during a heartbeat :

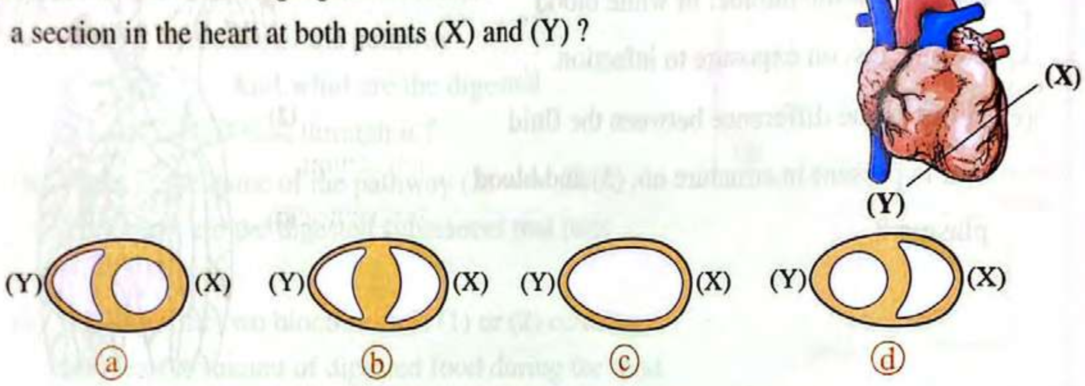


Which of the following represents the correct arrangement of the stages that occur after stage (Y) ?

ⓐ (X) → (L) → (Z).
ⓑ (L) → (X) → (Z).
ⓒ (L) → (Z) → (X).
ⓓ (Z) → (L) → (X).



4 Which of the following figures illustrates a section in the heart at both points (X) and (Y) ?



5 The following table shows some changes that happened in the blood components' concentration during its passage through an organ, from which of the following organs does this blood come out ?

Blood components	The change in concentration
CO_2	Increases
Glucose	Increases
O_2	Decreases
Amino acids	Increases

ⓐ Brain.
ⓑ Kidney.
ⓒ Small intestine.
ⓓ Liver.



Test on Chapter **2**

Transport in Living Organisms

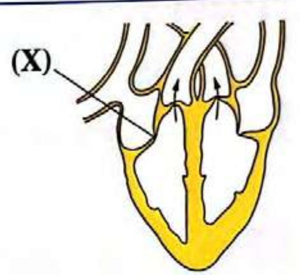
Choose the correct answer (1 : 20) :

1 In the opposite figure, what happens during this stage ?



ⓐ The bicuspid valve closes.
ⓑ The semi-lunar valves opens.
ⓒ The ventricles relax.
ⓓ The ventricles contract.

2 From the opposite figure, when a disturbance occurs in structure (X), the blood returns back again to the ....



ⓐ right atrium.
ⓑ left atrium.
ⓒ right ventricle.
ⓓ left ventricle.

3 Which of the following **doesn't** agree with the characteristics of the inferior vena cava ?

ⓐ It carries the blood at low pressure.
ⓑ It carries the blood to the heart.
ⓒ It carries deoxygenated blood.
ⓓ Its wall is thick.

4 *Chlamydomonas* alga shares *Amoeba* in that each of them ....

ⓐ contains specialized transport tissues.
ⓑ the gases are transferred to it from the surrounding medium by diffusion.
ⓒ the absorbed food substances are transferred through it by active transport.
ⓓ the absorbed food substances and gases are transferred through it by diffusion and active transport.

5 The following diagram represents a step in the formation of blood clot :

Damaged cells, blood platelets and blood clotting factors —**Compound (Y)**→ Prothrombin

Which of the following inhibits the activity of compound (Y) ?

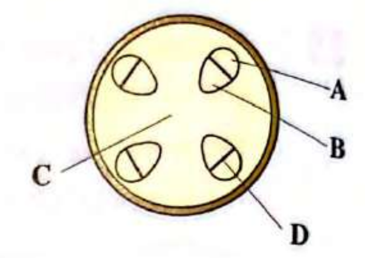
ⓐ Thrombin.
ⓑ Heparin.
ⓒ Fibrin.
ⓓ Vitamin (K).

6 Which of the following salts play an important role in regulating the blood pH value ?

ⓐ Sodium. ⓑ Chloride.

ⓒ Bicarbonate. ⓓ Calcium.

The opposite figure illustrates a diagrammatic section in the stem of a dicot plant, examine it, then answer :



7 What is the tissue that participates indirectly in increasing the efficiency of the transport process in the plant ?

ⓐ A ⓑ B

ⓒ C ⓓ D

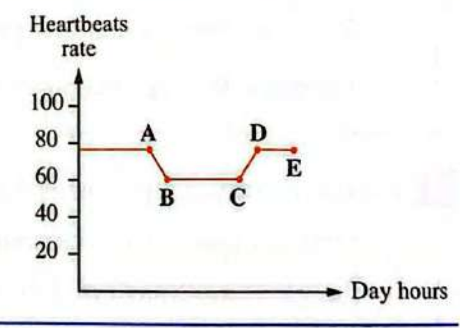
8 What is the tissue that contributes in supporting the plant ?

ⓐ A ⓑ B ⓒ C ⓓ D

9 Which of the following tissues **<u>doesn't</u>** contain parenchyma cells ?

ⓐ A ⓑ B ⓒ C ⓓ D

10 Study the opposite graph which shows the rate of heartbeats of a person during the day, what is the phase that represents the time of sleeping ?

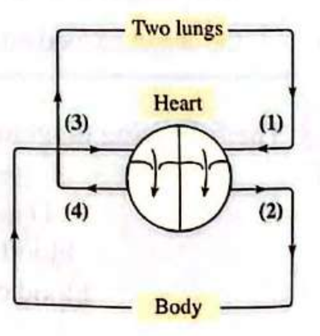




ⓐ CD ⓑ AB

ⓒ BC ⓓ DE

11 From the opposite diagram, which blood vessel has the highest blood pressure ?



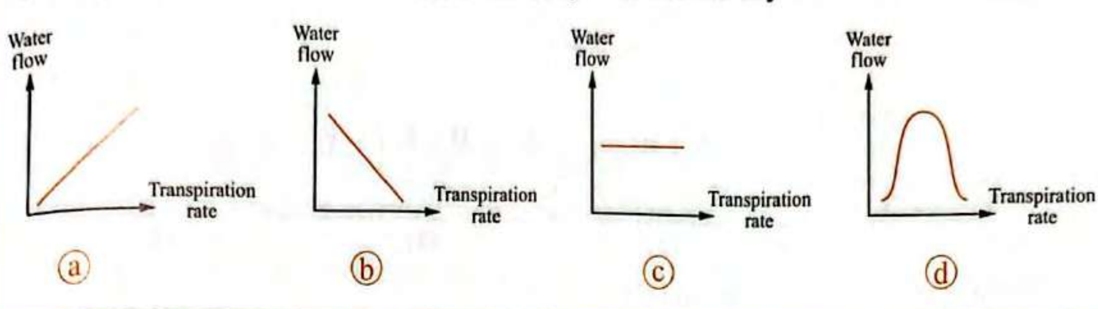
ⓐ (1).

ⓑ (2).

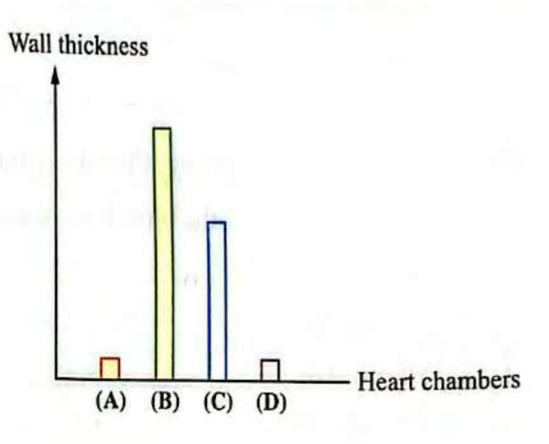
ⓒ (3).

ⓓ (4).

12 Which of the following graphs represents the relation between the rate of transpiration and the water flow in the stem within the early hours of the day ?

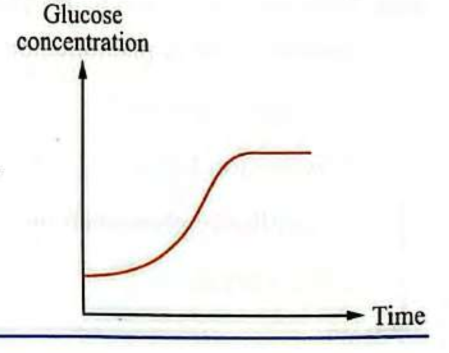


13 Study the opposite graph which expresses the difference in the thickness of muscular fibers which form the human heart chambers, which column represents the right ventricle ?



ⓐ (A).
ⓑ (B).
ⓒ (C).
ⓓ (D).

14 Study the opposite graph, which blood vessel is represented by the graph ?

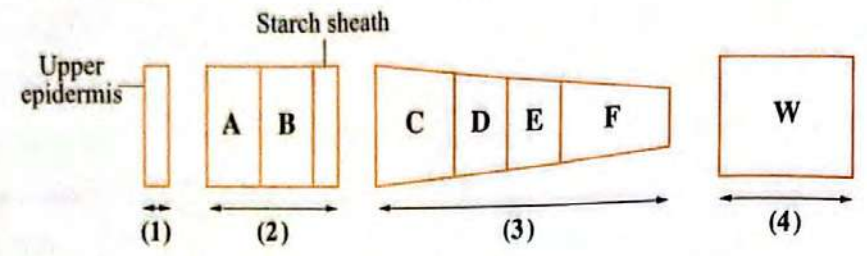


ⓐ Hepatic vein.
ⓑ Pulmonary artery.
ⓒ Hepatic portal vein.
ⓓ Hepatic artery.

15 Which of the following occurs to the plant during cold winter days ?

ⓐ Transpiration process increases and transporting of ready-made food decreases.
ⓑ Transpiration process decreases and transporting of ready-made food increases.
ⓒ Both transpiration process and transporting of ready-made food decrease.
ⓓ Both transpiration process and transporting of ready-made food increase.

16 Study the following diagram which shows 4 parts in the structure of a dicot plant stem which are arranged from outside to inside, then determine :



What is the function of (B) and (W) tissues ?

ⓐ Transporting inorganic substances.
ⓑ Elasticity and support.
ⓒ Aeration and storage.
ⓓ Transporting organic substances.

17 Study the opposite figure, then determine :



What is the value of the blood pressure in blood vessel (X) ?

ⓐ 10 mm Hg.
ⓑ 60 mm Hg.
ⓒ 80 mm Hg.
ⓓ 130 mm Hg.

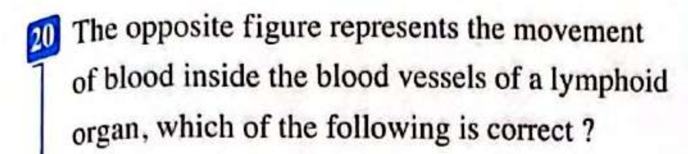
18 When the precipitation of lignin increases in the xylem vessels, the ascent of the sap increases, which phenomenon represents this relation ?

ⓐ Cohesion force.
ⓑ Adhesion force.
ⓒ Capillarity phenomenon.
ⓓ Root pressure.

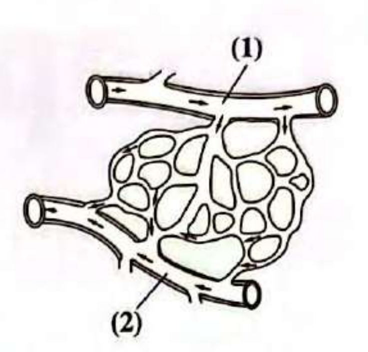
19 Which of the following transfers prothrombin to its activation site ?

ⓐ Blood platelets.
ⓑ WBCs.
ⓒ Blood plasma.
ⓓ RBCs.





20 The opposite figure represents the movement of blood inside the blood vessels of a lymphoid organ, which of the following is correct ?



ⓐ Vessel no. (1) is an artery carrying oxygenated blood.

ⓑ Vessel no. (2) is a vein carrying oxygenated blood.

ⓒ Vessel no. (1) is a vein carrying deoxygenated blood.

ⓓ Vessel no. (2) is an artery carrying deoxygenated blood.

Answer the following questions (21 : 23) :

21 **What is the relation between :** the number of white blood corpuscles and the exposure to an injury ?

____

22 **Explain :** the lymphatic system is considered a transport and immume system at the same time.

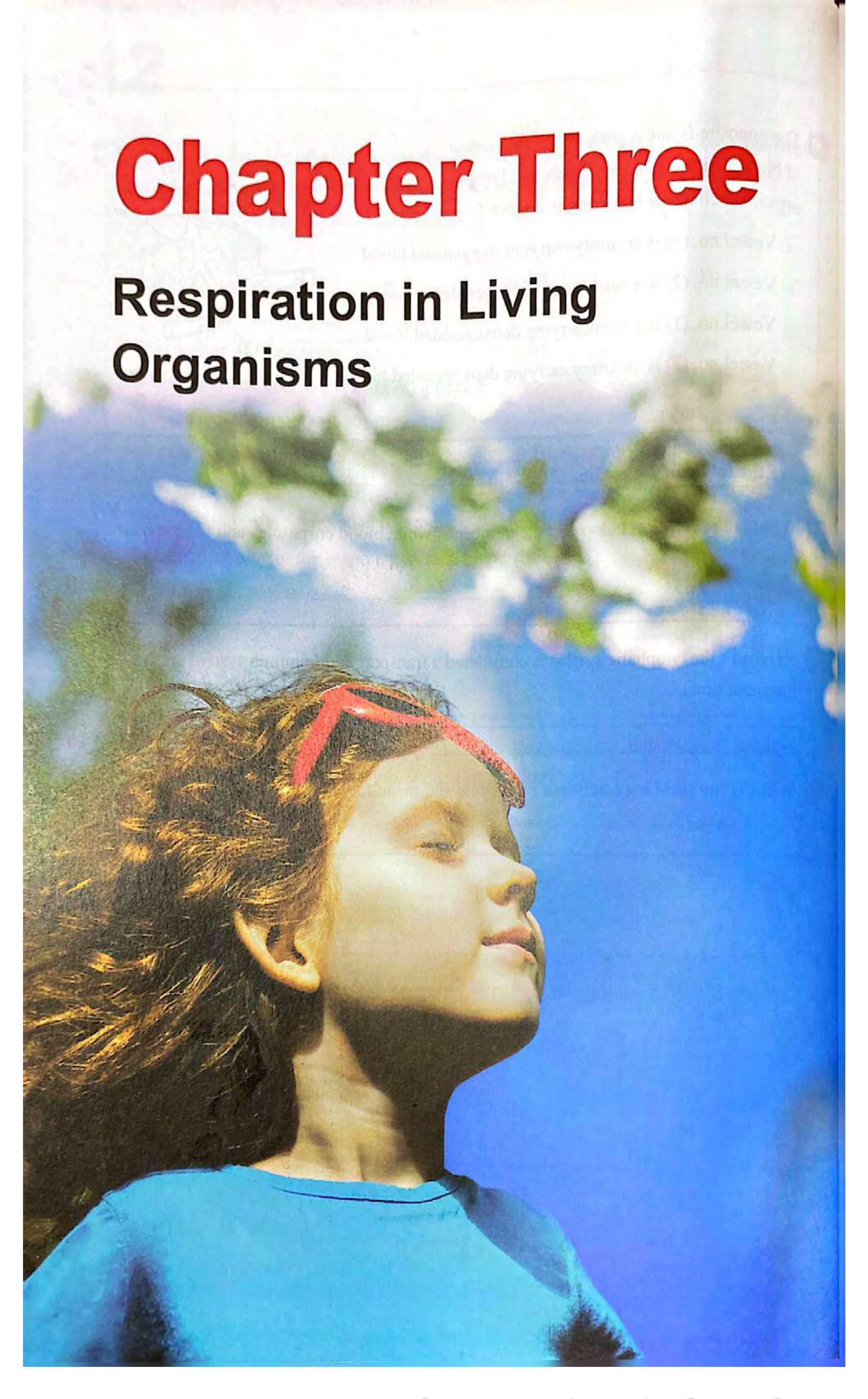
____

23 **What is the similarity between :** pericycle and medullary rays ?

____

Chapter Three

Respiration in Living Organisms



Lessons of the Chapter

Objectives of the chapter

By the end of this chapter, the student should be able to :

- Identify the concept of cellular respiration.
- Understand the steps of glycolysis and its importance.
- Identify the steps of aerobic respiration and where it takes place.
- Distinguish between the aerobic and anaerobic respirations.
- Identify the role of lungs in the respiration mechanism in man.
- State the importance of cellular respiration.
- Link between photosynthesis and respiration in plants.



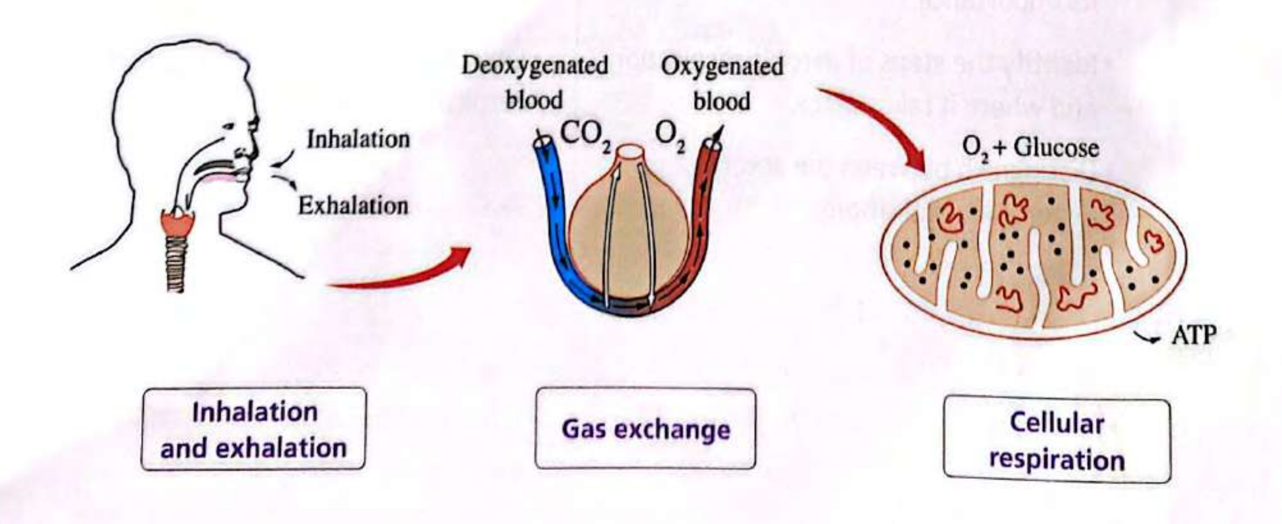
Chapter 3

Lesson One

Cellular Respiration

- **Before studying the cellular respiration, we must differentiate between the gas exchange and cellular respiration :**

Gas exchange	Cellular respiration
It is the process in which the living organism obtains **oxygen directly** from the surrounding medium, as in the **unicellular organisms** or by a **respiratory system**, as in the **multicellular organisms**, and releases **carbon dioxide** as a final product of respiration.	It is the vital process by which the living organism's cells extract the **energy stored** in the chemical bonds of food molecules, especially sugars (glucose) that are manufactured by the **plant** or eaten by the **animal**, then this energy is stored in the form of **ATP molecules** to be used in performing different activities.

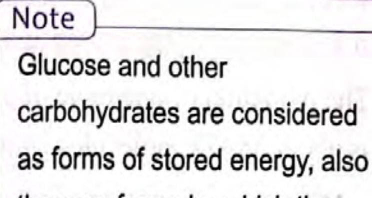


Cellular respiration

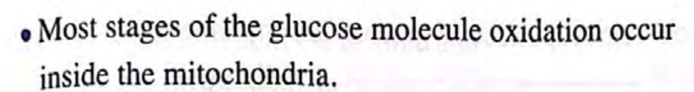




- The cellular respiration process starts by the oxidation of a **glucose molecule**, where the molecule of food is expressed usually by the glucose molecule, on illustrating the steps of its breaking down, as the majority of living organisms' cells use it to produce energy more than their use for any other molecules of the available food.



> **Note**
> Glucose and other carbohydrates are considered as forms of stored energy, also they are forms by which the energy transfers from one cell to another and from one living organism to another.



- Most stages of the glucose molecule oxidation occur inside the mitochondria.
- The energy released from cellular respiration is stored in ATP molecules (adenosine triphosphate).

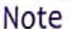
ATP molecules

- **A molecule of ATP is built up of three sub-units which are :**
  1. **Adenine :** a nitrogenous base (has basic properties).
  2. **Ribose :** a 5-carbon (pentose) sugar.
  3. **Three phosphate groups.**

Adenine
Ribose
P P P
3-phosphate groups

Structure of ATP

- ATP molecules are considered the universal currency of energy in the cell, as any energy required by the cell needs the presence of ATP molecules which are easily transferred, and when they change into ADP (adenosine diphosphate) molecules, an amount of energy is released from them (which is about 7 – 12 kcal/mol).



> **Note**
> ATP is similar to a coin that is characterized by being easily exchanged.

1 Test yourself



Choose the correct answer :

How can the conversion of ADP molecule into ATP molecule occur ?

(a) By breaking down a bond between two phosphate groups with releasing energy.
(b) By breaking down a bond between two phosphate groups in the presence of energy.
(c) By forming a bond between two phosphate groups with releasing energy.
(d) By forming a bond between two phosphate groups in the presence of energy.



First Aerobic cellular respiration

- It is the main route for obtaining energy in the majority of living organisms, and it takes place in the presence of oxygen.
- The oxidation of one mole of glucose ($C_6H_{12}O_6$) produces an amount of energy that is about 38ATP molecules , **and this can be illustrated by the following equation :**

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$$

Hint

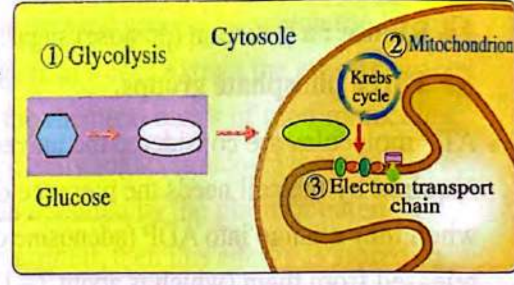
The overall reaction pathway for the aerobic respiration of glucose is summarized as follows :

$$C_6H_{12}O_6 + 6O_2 + 6H_2O \longrightarrow 6CO_2 + 12H_2O + \text{Energy}$$

Note that water is shown in both sides of the equation, because it is a reactant in some reactions and a product in others, so the equation can be simplified to indicate that there is a net yield of water : $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy}$

Stages of glucose molecule oxidation

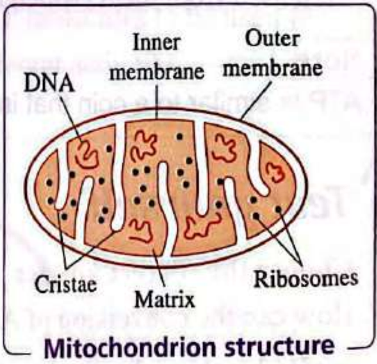
- **The oxidation of glucose molecule takes place in three major stages, as follows :**



1. Glycolysis occurs in the cytosole (non-organelle part of cytoplasm) of the cell.
2. Krebs cycle occurs inside the mitochondria.
3. Electron transport chain occurs inside the mitochondria.

As the mitochondria contain :

- The respiratory enzymes.
- Water.
- Coenzymes.
- Phosphate groups.
- Electron carrier molecules (Cytochromes) that carry the electrons at different energy levels, where the hydrogen atoms are removed during the reaction to be passed to the coenzymes.



Mitochondrion structure

From the most important coenzymes

NAD⁺ which is **reduced** into NADH :	FAD which is **reduced** into $FADH_2$:
$NAD^+ + H_2 \xrightarrow{\text{Reduction}} NADH + H^+$	$FAD + H_2 \xrightarrow{\text{Reduction}} FADH_2$

Test yourself

Answered

Choose the correct answer :

What is the approximate amount of the energy produced from the aerobic oxidation of one molecule of glucose ?

ⓐ 12 kcal/mol. ⓑ 38 kcal/mol. ⓒ 360 kcal/mol. ⓓ 3800 kcal/mol.

1 Glycolysis



- It takes place in both the aerobic and anaerobic respirations to produce energy, where glycolysis stage occurs in the absence or lack of oxygen.
- **Site of its occurrence :**
  It occurs in the **cytosole.**
- **Steps of glycolysis :**
  One molecule of glucose (6-carbon) is broken down into two molecules of pyruvic acid (3-carbon) through a group of reactions, **as follows :**

  1. **Glucose molecule** is converted into glucose 6-phosphate, **then** fructose 6-phosphate, **then** fructose 1,6-diphosphate.
  2. Fructose 1,6-diphosphate (6C) is broken down into two molecules of phosphoglyceraldehyde (3C).
  3. Each molecule of phosphoglyceraldehyde (PGAL) is oxidized into pyruvic acid molecule, therefore **two molecules of pyruvic acid** are produced.

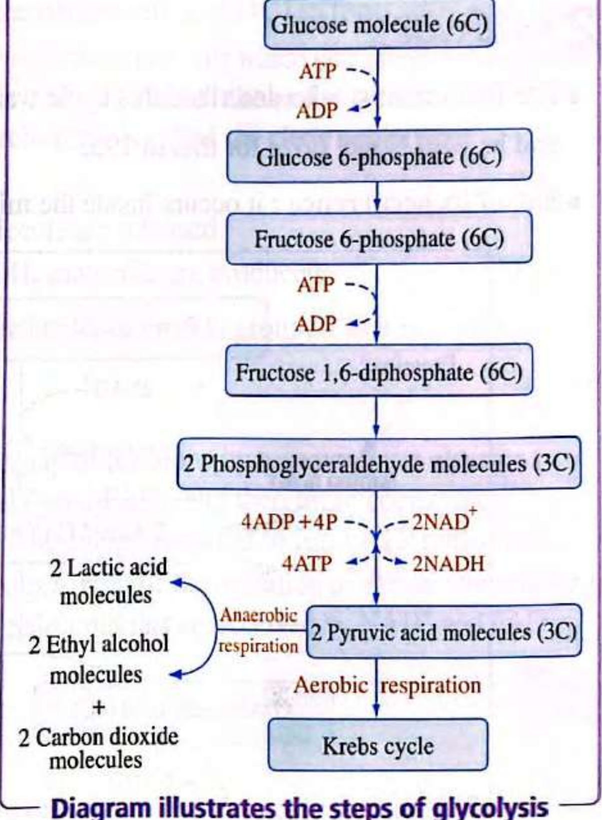


Diagram illustrates the steps of glycolysis

- These reactions are accompanied by **(for each molecule of glucose) :**
  - Reducing two molecules of the coenzyme $2NAD^+ \longrightarrow 2NADH$
  - Producing two molecules of ATP in the cytosole of the cell.
- **The equation of the reaction :**

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow[\text{Respiratory enzymes}]{\text{(Anaerobic respiration)}} \underset{\text{Pyruvic acid}}{2C_3H_4O_3} + 2ATP$$

- **The produced energy :**

Two molecules of ATP which are not enough to perform all the vital activities in the living organisms, therefore in case of the presence of oxygen, pyruvic acid passes into the mitochondria to produce more energy, and this takes place in two stages, **which are :**

- **Krebs cycle.**
- **Electron transport chain.**

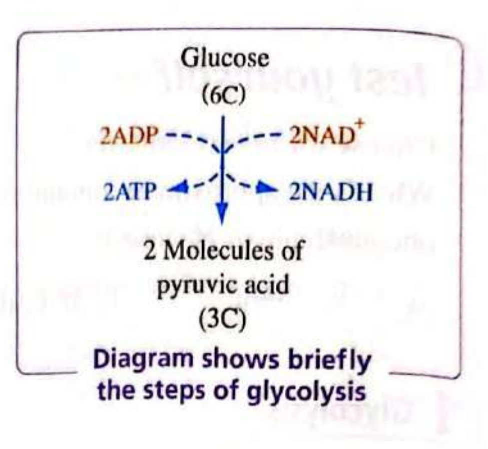


Diagram shows briefly the steps of glycolysis

- **The importance of glycolysis :**
  - The production of two molecules of ATP
  - Obtaining pyruvic acid which is used in both aerobic and anaerobic respirations.

2 Krebs cycle

- The first scientist who described this cycle was **Sir Hans Krebs** in 1937, and he won Nobel prize for that in 1953


Hans Krebs

- **Site of its occurrence :** it occurs inside the **mitochondria**.

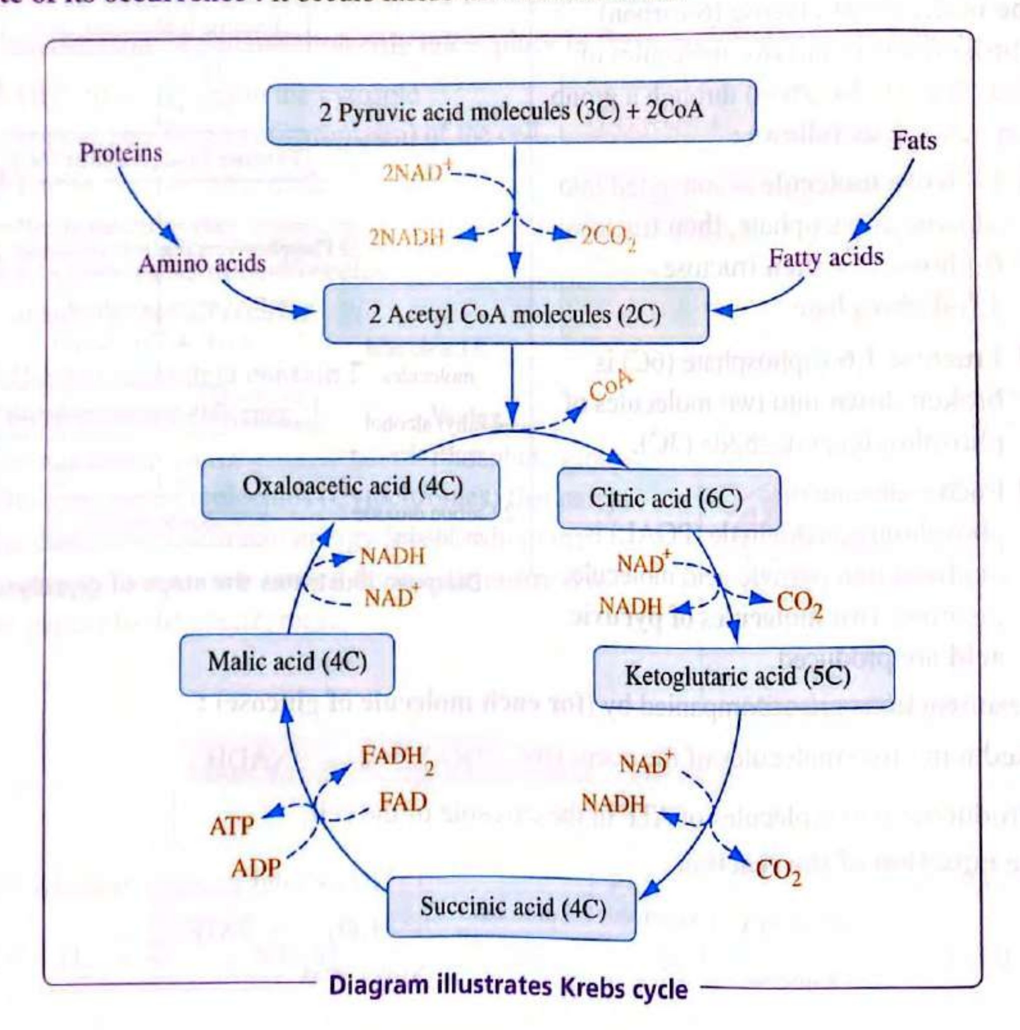


Diagram illustrates Krebs cycle

- **Before entering into Krebs cycle, the following occurs :**



Each molecule of pyruvic acid is oxidized to change into acetyl group that combines with the coenzyme (A) **"CoA"**, forming acetyl coenzyme (A) **"Acetyl CoA", and this produces :**

- 2 molecules of NADH
- 2 molecules of CO_2

Note

The other acetyl groups resulting from the breaking down of fatty acids and amino acids molecules can combine with the CoA to join the Krebs cycle.

- **Krebs cycle steps :**

1. Each molecule of acetyl CoA joins the Krebs cycle, where the CoA splits off the acetyl group to repeat its role in another cycle.
2. The acetyl group **(2C)** combines with the oxaloacetic acid **(4C)** to form citric acid **(6C)**.
3. The citric acid passes through three intermediate compounds which **start** by the ketoglutaric acid **(5C)**, succinic acid **(4C)**, **then** malic acid **(4C)**, and **at the end** of the reactions citric acid is formed again **(therefore Krebs cycle is called the citric acid cycle)**.

- **During one Krebs cycle :**
  - Two molecules of CO_2 and one ATP molecule are released.
  - Three molecules of NADH and one $FADH_2$ molecule are produced.

- Krebs cycle is repeated twice for each molecule of the acetyl group, (i.e. it is repeated twice for one glucose molecule).

- **The importance of Krebs cycle :**

The oxidation of carbon atoms through a group of reactions by removing the electrons which are received by the coenzymes (NAD^+ and FAD), and then these coenzymes transfer them to the cytochromes to release the energy required to form ATP molecules.

- Krebs cycle doesn't require the presence of oxygen, because the oxidation of carbon atoms during the Krebs cycle reactions is occurred by losing electrons that are received by NAD^+ and FAD

3 Test yourself

Answered

1 Choose the correct answer :

(1) Which of the following is required in order to start the glycolysis process ?

(a) 2 molecules of ATP
(b) 2 molecules of NAD^+
(c) 4 molecules of ADP
(d) 4 phosphate groups.

(2) Which of the following acids is formed from the acid that precedes it in Krebs cycle, without the reduction of coenzymes ?

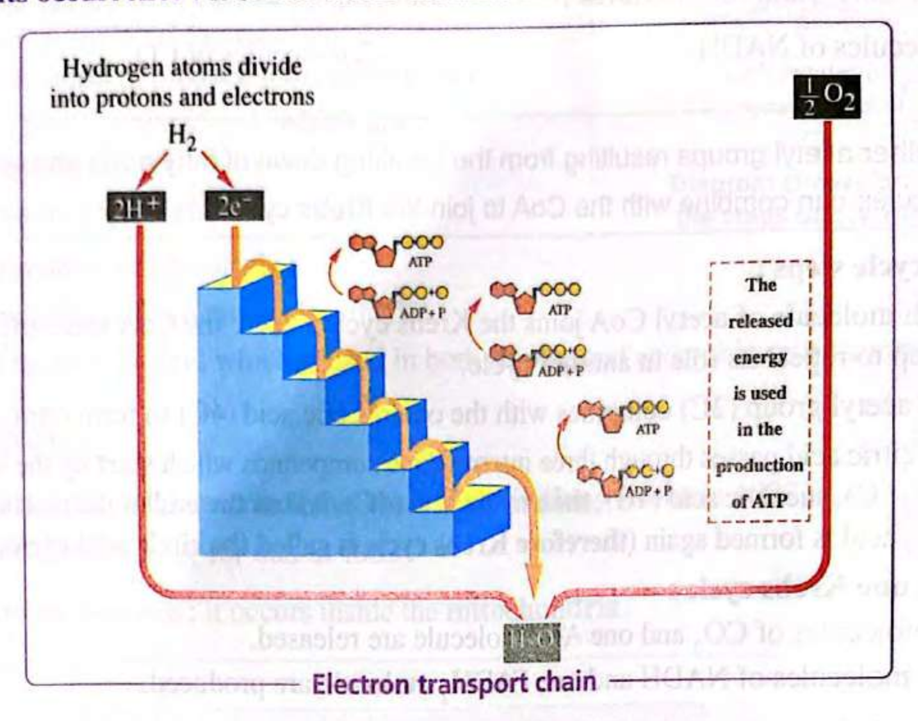
(a) Citric acid.
(b) Ketoglutaric acid.
(c) Malic acid.
(d) Oxaloacetic acid.

2 What happens for : CO_2 molecules that are resulted from Krebs cycle ?

....

3 Electron transport chain

- The terminal (last) stage of aerobic respiration that starts with the end of Krebs cycle.
- **Site of its occurrence :** it occurs inside the **mitochondria**.



Electron transport chain

- **Electron transport chain steps :**

1. Hydrogen and high-energy electrons that are carried on each of NADH and $FADH_2$ are passed through a certain sequence of coenzymes called **"cytochromes"** (electrons carriers) that are present in the inner membrane of mitochondria.
2. The cytochromes carry the electrons at different energy levels. During the passage of these high-energy electrons from one molecule of cytochrome to another, a sufficient energy is released to form ATP molecules from ADP molecules, which is called **"oxidative phosphorylation"**.
3. A pair of electrons combines with a pair of H^+, then with one oxygen atom to form a water molecule, **according to the following equation :**

$$2e^- + 2H^+ + \frac{1}{2}O_2 \longrightarrow H_2O$$

So, oxygen is considered the last receptor in the electron transport chain.

Note

In the electron transport chain, each NADH molecule produces three molecules of ATP, while each $FADH_2$ molecule produces two molecules of ATP

- **The importance of electron transport chain :**

Releasing the energy stored in NADH and $FADH_2$ molecules through the passage of electrons over a sequence of cytochromes and using the produced energy to form ATP molecules from ADP molecules.

Key Points

- A molecule of NADH that carries two electrons, loses them when converted into NAD^+ molecule and vice versa, depending on the following reaction :

$$NADH \rightleftharpoons NAD^+ + H^+ + 2e^-$$

- A molecule of $FADH_2$ that carries two electrons, loses them when converted into FAD molecule and vice versa, depending on the following reaction :

$$FADH_2 \rightleftharpoons FAD + 2H^+ + 2e^-$$

Calculating the number of ATP molecules

- In aerobic respiration (the presence of oxygen), the oxidation of one molecule of glucose produces **38** ATP molecules, **where :**
  - **2** molecules in the cytoplasm of the cell (during glycolysis).
  - **36** molecules in the mitochondria (during the respiration stage).
- **This is illustrated in the following diagram :**

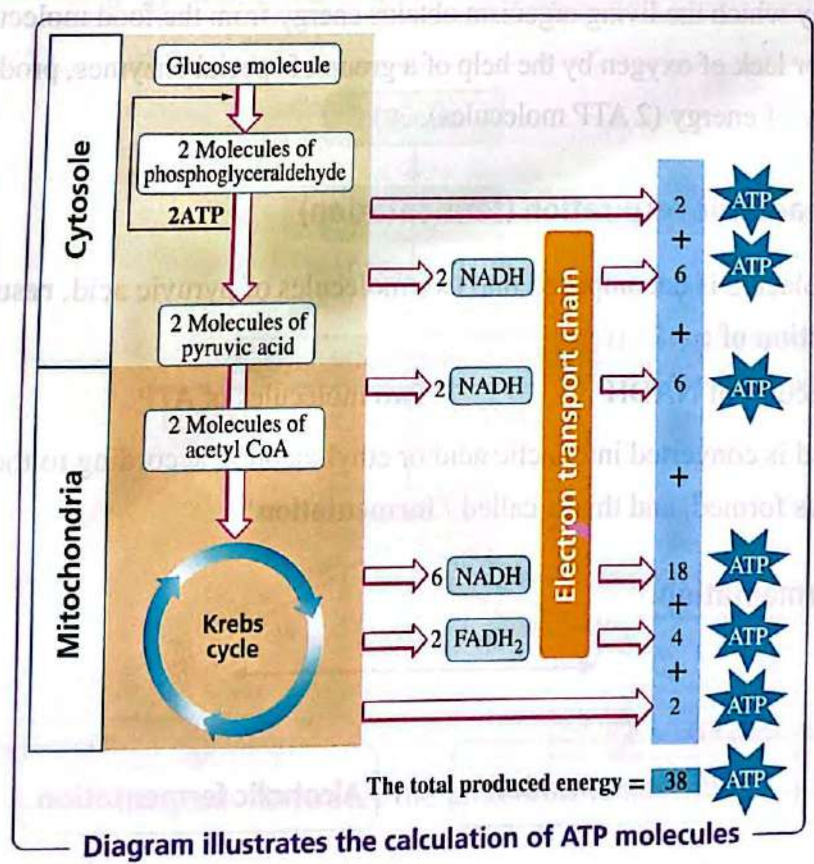
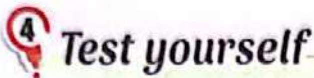


Diagram illustrates the calculation of ATP molecules





Test yourself

Answered

Choose the correct answer :

1 What is the indication of the presence of 6 molecules of water in the following equation : ($C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$) ?

(a) Glycolysis of a glucose molecule.
(b) The occurrence of Krebs cycle twice.
(c) The occurrence of complete oxidative phosphorylation process.
(d) Storage of energy in NADH and $FADH_2$ molecules.

2 If the stored energy is not released from the coenzymes during the electron transport chain, what is the number of ATP molecules that are resulted from the oxidation of one glucose molecule aerobically ?

(a) 2 ATP molecules.
(b) 4 ATP molecules.
(c) 8 ATP molecules.
(d) 16 ATP molecules.

Second — Anaerobic cellular respiration

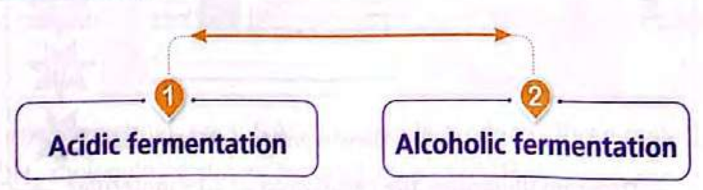
The anaerobic respiration (Fermentation) :

It is a process by which the living organism obtains energy from the food molecule (glucose) in the absence or lack of oxygen by the help of a group of special enzymes, producing a small quantity of energy (2 ATP molecules).

Stages of anaerobic respiration (fermentation)

1. Glucose molecule is decomposed into two molecules of pyruvic acid, **resulting in the production of :**
   - Two molecules of NADH
   - Two molecules of ATP
2. Pyruvic acid is converted into lactic acid or ethyl alcohol, according to the type of cell in which it was formed, and this is called **"fermentation"**.

Types of fermentation



1 Acidic fermentation : as in animal cells (especially the muscular cells) and bacteria, where :

- **In the muscle cells,** when the muscles exert vigorous efforts or exercises, they resort to the anaerobic respiration, where they consume most of the oxygen that is present in them and tend to reduce the pyruvic acid into lactic acid ($C_3H_6O_3$) through its combination with the electrons that are carried on NADH, causing what is known by the "**muscle fatigue**".
- **In bacteria,** the pyruvic acid is reduced into lactic acid in the absence of oxygen, and many dairy industries depend on this type of fermentation, such as cheese, butter and yoghurt.

Notes

- If oxygen is available, lactic acid is oxidized into pyruvic acid again, then into acetyl CoA to complete the stages of aerobic cellular respiration and produce energy.
- Seeds of seed plants have the ability to respire anaerobically, if they are kept in anaerobic conditions.

$$C_6H_{12}O_6 \xrightarrow{\text{Acidic fermentation}} 2C_3H_6O_3 + 2ATP$$

2 Alcoholic fermentation : as in yeast and some plant tissues, where pyruvic acid is reduced into ethyl alcohol (ethanol) and carbon dioxide is released. This is used in the industry of some products, such as alcohol and bread industries.

$$C_6H_{12}O_6 \xrightarrow{\text{Alcoholic fermentation}} 2C_2H_5OH + 2CO_2 + 2ATP$$

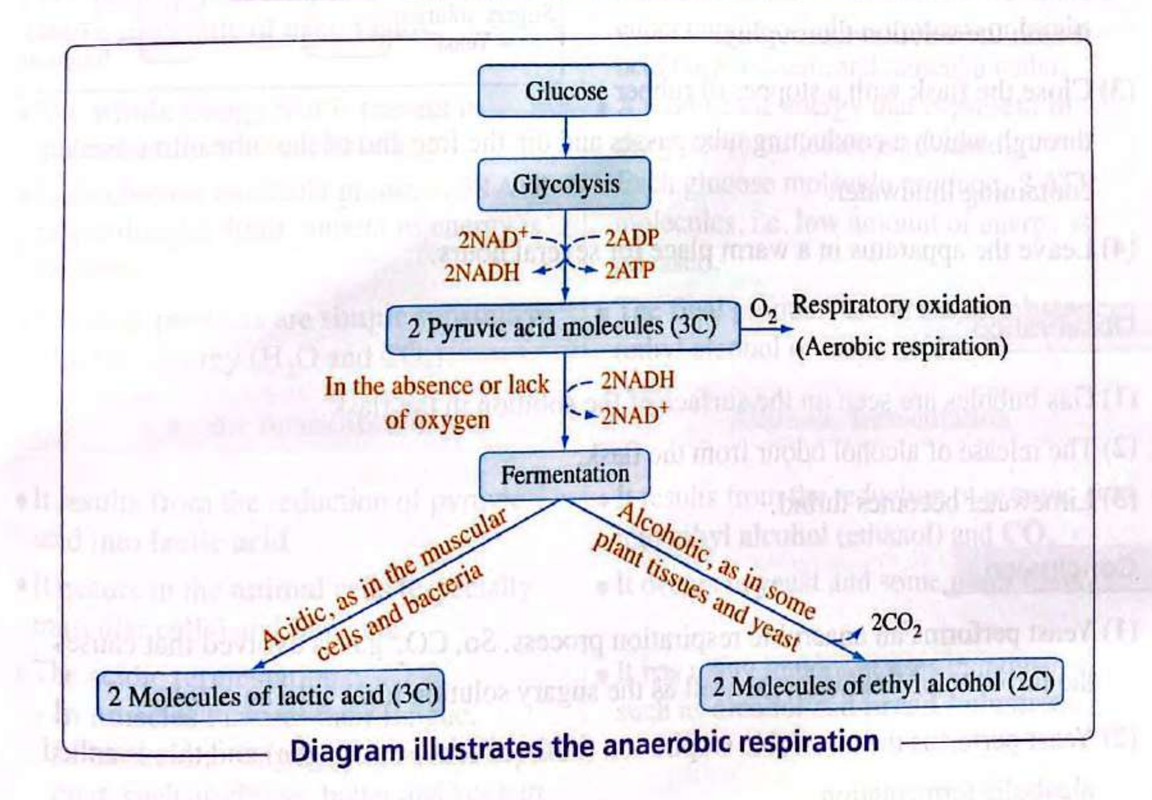


Diagram illustrates the anaerobic respiration



Key Point

Although the ATP molecules are not produced on the fermentation of pyruvic acid, it is an important step after glycolysis during the anaerobic respiration, where two molecules of NAD^+ are re-produced to continue the glycolysis process and obtaining more ATP molecules.



5 Test yourself

Answered

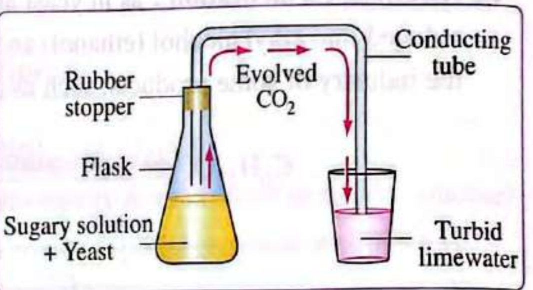
Choose the correct answer :

Which of the following should be provided with a sufficient amount to remove the muscle fatigue ?

ⓐ Glucose. ⓑ Oxygen. ⓒ Glycogen. ⓓ Glucose and oxygen.

Experiment — The proof of anaerobic respiration process (The proof of alcoholic fermentation process)

1. Steps :



(1) Put a sugary solution (or molasses that is diluted with water by a ratio of 1 : 2 respectively) in a conical flask.

(2) Add a piece of yeast into the flask and mix it with the solution thoroughly.

(3) Close the flask with a stopper of rubber through which a conducting tube passes and dip the free end of the tube into a beaker containing limewater.

(4) Leave the apparatus in a warm place for several hours.

2. Observation :

(1) Gas bubbles are seen on the surface of the solution in the flask.

(2) The release of alcohol odour from the flask.

(3) Limewater becomes turbid.

3. Conclusion :

(1) Yeast performs an anaerobic respiration process. So, CO_2 gas is evolved that causes the turbidity of limewater, as well as the sugary solution turns into an alcohol.

(2) Yeast performs the anaerobic respiration (in the absence of oxygen) and this is called alcoholic fermentation.

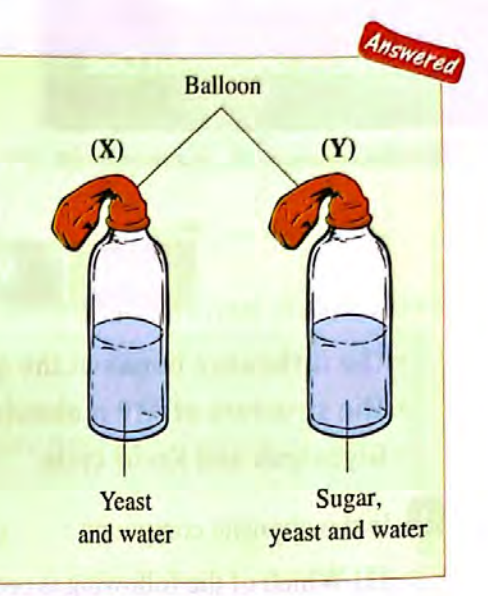


6 Test yourself

Answered

Choose the correct answer :

The opposite figure illustrates an experiment for the detection of the anaerobic respiration, where two bottles with two balloons are put inside a warm room, what happens for the two balloons (X) and (Y) after 24 hours respectively ?



(a) Inflate / Inflate.
(b) Inflate / Unchanged.
(c) Unchanged / Inflate.
(d) Unchanged / Unchanged.

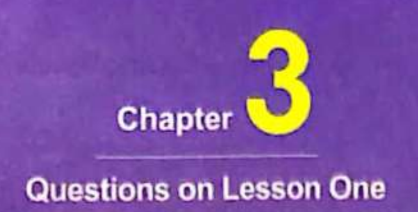
From the previous, we can make the following comparisons :

1

Aerobic respiration	Anaerobic respiration
• It **requires** the presence of oxygen for the combination of electrons and protons together, then with oxygen to form water.	• It **doesn't require** the presence of oxygen, but it occurs by the help of a group of enzymes.
• A part of it occurs in the **cytoplasm** and the rest in the **mitochondria**.	• All of it occur in the **cytoplasm**.
• The pyruvic acid molecule is converted into **a molecule of acetyl CoA**	• The pyruvic acid molecule is converted into either **ethyl alcohol** (as in yeast) or **lactic acid** (as in bacteria and muscular cells).
• The **whole** energy that is present in glucose molecule is released.	• **A part** of the energy that is present in the glucose molecule is released.
• Each glucose molecule produces 38 ATP molecules, i.e. **high** amount of energy is released.	• Each glucose molecule produces 2 ATP molecules, i.e. **low** amount of energy is released.
• The final products are **simple substances** with low-energy (H_2O and CO_2).	• The final products are **organic substances** (ethyl alcohol or lactic acid).

2

Acidic fermentation	Alcoholic fermentation
• It results from the reduction of pyruvic acid into **lactic acid**.	• It results from the reduction of pyruvic acid into **ethyl alcohol** (ethanol) and CO_2
• It occurs in the **animal cells** (especially muscular cells) and **bacteria**.	• It occurs in **yeast** and some **plant** tissues.
• The acidic fermentation : - **In muscles :** causes their fatigue. - **In bacteria :** many dairy industries depend on it, such as cheese, butter and yoghurt.	• It has many important uses in industries, such as **alcohol** and **bread industries**.



Cellular Respiration



The questions signed by ✳ are answered in detail.   ● Understand   ● Apply   ● Analyze



First Multiple Choice Questions

- The difference between the gas exchange and cellular respiration.
- The structure of ATP molecule.
- Glycolysis and Krebs cycle.

1 In the opposite compound :

(1) Which of the following is produced, when bond (X) is broken down ?

ⓐ Energy. ⓑ ATP
ⓒ Water. ⓓ Carbon dioxide.

(2) Which part is specialized in storing energy ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

2 Which of the following is the reason that ATP molecules represent the energy currency in the cell ?

ⓐ They are the smallest molecules of energy in the cell.
ⓑ They store the least amount of energy in the cell.
ⓒ They transfer the energy easily to perform the function of the cell.
ⓓ They can save their energy for a long period.

3 What is the difference between the structure of ATP molecule and ADP molecule ?

ⓐ Type of sugar. ⓑ Type of nitrogenous base.
ⓒ Number of phosphate groups. ⓓ Number of carbon atoms.

4 Which of the following molecules is splitted during glucose oxidation ?

ⓐ Glucose. ⓑ Phosphoglyceraldehyde.
ⓒ Fructose 1,6-diphosphate. ⓓ Glucose 6-phosphate.

5 In which of the following molecules the amount of energy that is produced directly from glycolysis in the cytosole is stored ?

ⓐ ATP ⓑ NADH
ⓒ $FADH_2$ ⓓ ATP and NADH

6 The following reaction occurs during glycolysis when .... is formed.

ⓐ glucose 6-phosphate
ⓑ fructose 6-phosphate
ⓒ fructose 1,6-diphosphate
ⓓ pyruvic acid

7 What is the number of NADH compounds that are resulted from two cycles of citric acid ?

ⓐ 3 ⓑ 6 ⓒ 12 ⓓ 18

8 What is the number of ATP molecules that are produced from the glycolysis of 4 molecules of glucose in the cytosole ?

ⓐ 4 ⓑ 8 ⓒ 12 ⓓ 16

9 The fatty acids enter in the cellular respiration in the form of .... molecule(s).

ⓐ (1C) ⓑ (2C) ⓒ (3C) ⓓ (4C)

10 What is the number of ATP molecules that are resulted directly from the complete oxidation of 2 glucose molecules during Krebs cycle inside the mitochondria ?

ⓐ 4 ⓑ 38 ⓒ 72 ⓓ 76

11 What is the number of ATP molecules that are produced on the oxidation of one glucose molecule in the presence of oxygen during the aerobic respiration process in the cytoplasm of the cell ?

ⓐ 38 molecules. ⓑ 36 molecules. ⓒ Two molecules. ⓓ One molecule.

12 Which of the following **doesn't/don't** produce ATP molecules ?

ⓐ Krebs cycle.
ⓑ Glycolysis.
ⓒ Light reactions in grana.
ⓓ Dark reactions in stroma.

13 What is the number of Krebs cycles required for the complete oxidation of two glucose molecules ?

ⓐ Once. ⓑ Twice. ⓒ Three times. ⓓ Four times.

14 The amino acids enter in the cellular respiration in the form of .... molecule(s).

ⓐ (1C) ⓑ (2C) ⓒ (3C) ⓓ (4C)

15 What happens to the intermediate compounds in Krebs cycle ?

ⓐ Oxidation by adding oxygen.
ⓑ Reduction by gaining hydrogen.
ⓒ Oxidation by losing electrons.
ⓓ Reduction by gaining electrons.

16 How is this equation ($C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$) affected when the number of coenzymes decreases in mitochondria ?

(a) Glucose will be formed again.

(b) Water is not from the reaction products.

(c) The rate of ATP molecules production will be affected.

(d) The number of CO_2 molecules decreases.

17 ✻ Which of the following compounds loses phosphate groups during glycolysis ?

(a) Glucose 6-phosphate. (b) Fructose 6-phosphate.

(c) Fructose 1,6-diphosphate. (d) Phosphoglyceraldehyde.

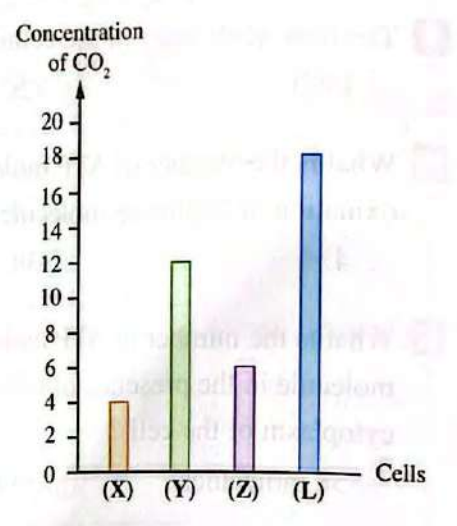
18 ✻ The opposite graph represents the amount of CO_2 that is liberated through aerobic respiration process, in which cells is the complete oxidation of 3 glucose molecules occurred ?

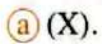
(a) (X).

(b) (Y).

(c) (Z).

(d) (L).





* **Electron transport chain.**
* **Anaerobic respiration.**

19 How is the oxidation of glucose in case of aerobic cellular respiration occurred ?

(a) By combining the glucose with oxygen. (b) By losing hydrogen from glucose.

(c) By combining the glucose with hydrogen. (d) By losing electrons from glucose.

20 Which of the following occurs in case of the presence or absence of oxygen in the living cell ?

(a) Glycolysis.

(b) Conversion of pyruvic acid into acetyl CoA

(c) Citric acid cycle.

(d) Oxidative phosphorylation.



21 Which of the following is occurred to NAD^+ molecules during aerobic respiration ?

ⓐ They are oxidized during Krebs cycle.

ⓑ They are reduced during Krebs cycle.

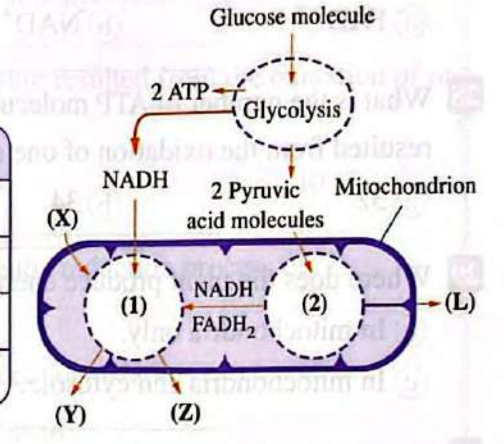
ⓒ They are oxidized through electron transport chain.

ⓓ They are reduced through electron transport chain.

22 If it is possible to stop the reactions of Krebs cycle on the formation of succinic acid and releasing the energy from the coenzymes, what is the number of ATP molecules that are resulted indirectly from one molecule of pyruvic acid ?

ⓐ 6 ⓑ 9 ⓒ 12 ⓓ 18

23 From the opposite diagram :



(1) Which of the following is correct ?

	(X)	(Y)	(Z)	(L)
ⓐ	CO_2	ATP	H_2O	O_2
ⓑ	H_2O	CO_2	O_2	ATP
ⓒ	ATP	O_2	CO_2	H_2O
ⓓ	O_2	ATP	H_2O	CO_2

(2) Which of the following occurs in process (1) ?

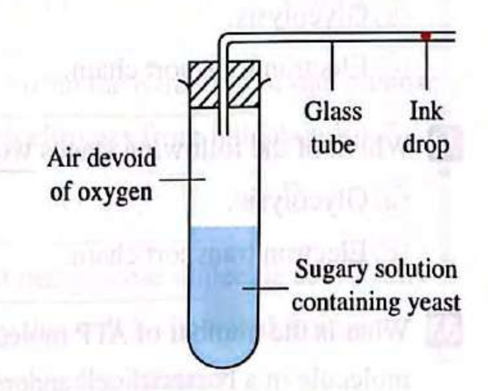
ⓐ Coenzymes oxidation. ⓑ Coenzymes reduction.

ⓒ Releasing of CO_2 ⓓ Releasing of O_2

(3) What is the number of ATP molecules that are resulted directly from process (2) for one pyruvic acid molecule ?

ⓐ 1 ⓑ 2 ⓒ 34 ⓓ 38

24 The opposite figure illustrates a device used in the detection of respiration in yeast, what will happen to the ink drop ?



ⓐ It moves quickly inwards.

ⓑ It moves slowly inwards.

ⓒ It moves outwards.

ⓓ It remains constant.

25 In the equation : ($C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2$), when CO_2 gas is released ?

(a) During glycolysis. (b) During Krebs cycle only.

(c) Before and during Krebs cycle. (d) During electron transport chain.

26 Study the following equation, then determine :

$$H_2O + CO_2 \xrightarrow{\text{Process (X)}} \text{Glucose} \xrightarrow{\text{Process (Y)}} 38 \text{ ATP}$$

Which of the following depends on the two processes (X) and (Y) for obtaining energy ?

(a) Bean. (b) Yeast. (c) Saprophytic bacteria. (d) *Amoeba*.

27 What is the coenzyme that receives hydrogen in each of the cytosole and mitochondria ?

(a) FAD (b) NAD^+ (c) CoA (d) Cytochrome.

28 What is the number of ATP molecules that are formed in the electron transport chain and resulted from the oxidation of one glucose molecule ?

(a) 32 (b) 34 (c) 36 (d) 38

29 Where does the plant produce energy during aerobic cellular respiration process ?

(a) In mitochondria only. (b) In cytosole only.

(c) In mitochondria and cytosole. (d) No correct answer.

30 By which of the following the electron transport chain is described ?

(a) Molecules carriers that change by changing enzymes.

(b) The oxidative phosphorylation cycle.

(c) The oxidation and reduction reactions.

(d) An exothermic reaction.

31 In which of the following stages the largest amount of ATP molecules is released directly ?

(a) Glycolysis. (b) One Krebs cycle.

(c) Electron transport chain. (d) Krebs cycle and electron transport chain.

32 Which of the following stages **won't** occur in case of the absence of ATP molecules ?

(a) Glycolysis. (b) Oxidation of pyruvic acid aerobically.

(c) Electron transport chain. (d) Fermentation of pyruvic acid.

33 What is the number of ATP molecules that are resulted from the oxidation of one glucose molecule in a bacterial cell anaerobically ?

(a) 2 (b) 34 (c) 36 (d) 38

34 What is the ratio of the energy released from the aerobic respiration to that of the anaerobic respiration for one glucose molecule ?

ⓐ 1 : 1 ⓑ 19 : 1 ⓒ 38 : 1 ⓓ 19 : 2

35 In case of the absence or lack of oxygen, NADH compound that is resulted from the glycolysis donates its electrons to the ....

ⓐ pyruvic acid. ⓑ cytochromes. ⓒ citric acid. ⓓ lactic acid.

36 What is/are the substance(s) that doesn't/don't supply the cell with energy ?

ⓐ Lipids. ⓑ Proteins.

ⓒ Water. ⓓ Carbohydrates.

37 What is the total number of NADH compounds that are resulted from the oxidation of one glucose molecule in the anaerobic respiration ?

ⓐ Zero. ⓑ 2 ⓒ 4 ⓓ 10

38 Which of the following conversions doesn't include the reduction process of the coenzymes ?

ⓐ The formation of pyruvic acid from phosphoglyceraldehyde.

ⓑ The formation of succinic acid from ketoglutaric acid.

ⓒ The formation of malic acid from succinic acid.

ⓓ The formation of lactic acid from pyruvic acid.

39 What is the number of the reduced NAD^+ and FAD molecules that are resulted from each glucose molecule entering in the cellular respiration process in the presence of oxygen respectively ?

ⓐ 10 and 2 ⓑ 5 and 1 ⓒ 10 and 1 ⓓ 5 and 2

40 What is the number of ATP molecules that are resulted from the oxidation of one glucose molecule in the presence of oxygen and absence of cytochromes from mitochondria ?

ⓐ Zero. ⓑ 2 ⓒ 4 ⓓ 38

41 If the released amount of energy from the oxidation of one glucose molecule aerobically equals 2880 kJ, what is the expected amount of energy that will be liberated from one glucose molecule in a skeletal muscle during the anaerobic respiration ?

ⓐ 75 kJ ⓑ 150 kJ ⓒ 300 kJ ⓓ 450 kJ

42 Which of the following is a similarity between the aerobic and anaerobic respirations ?

ⓐ The formation of pyruvic acid.
ⓑ Needing a little amount of oxygen.
ⓒ Producing CO_2 gas in muscles.
ⓓ Producing ethyl alcohol in yeast.

43 What is the process that is occurred to NADH when pyruvic acid is converted into lactic acid ?

ⓐ Reduction.
ⓑ Oxidation.
ⓒ Glycolysis.
ⓓ Lysis.

44 * What is the reason for being the energy resulted from the anaerobic respiration in the muscles less than the energy resulted from the aerobic respiration ?

ⓐ The consumption of energy in the formation of CO_2
ⓑ The consumption of energy in the formation of O_2
ⓒ The remaining of energy stored in the pyruvic acid.
ⓓ The remaining of energy stored in the lactic acid.

45 * The opposite graph expresses the organic compounds that are formed during the cellular respiration inside the cell cytoplasm of a living organism in case of lack of oxygen, what is the living organism that performs this type of respiration ?

ⓐ *Paramecium*.
ⓑ Bacteria.
ⓒ *Amoeba*.
ⓓ Yeast fungus.

46 * If 30 NADH molecules are produced from Krebs cycle to enter the electron transport chain, how many pyruvic acid molecules enter into mitochondria to share in the reactions ?

ⓐ 5 molecules.
ⓑ 10 molecules.
ⓒ 15 molecules.
ⓓ 20 molecules.

47 * How many ATP molecules are resulted after the electron transport chain from 10 pyruvic acid molecules ?

ⓐ 150
ⓑ 170
ⓒ 180
ⓓ 190

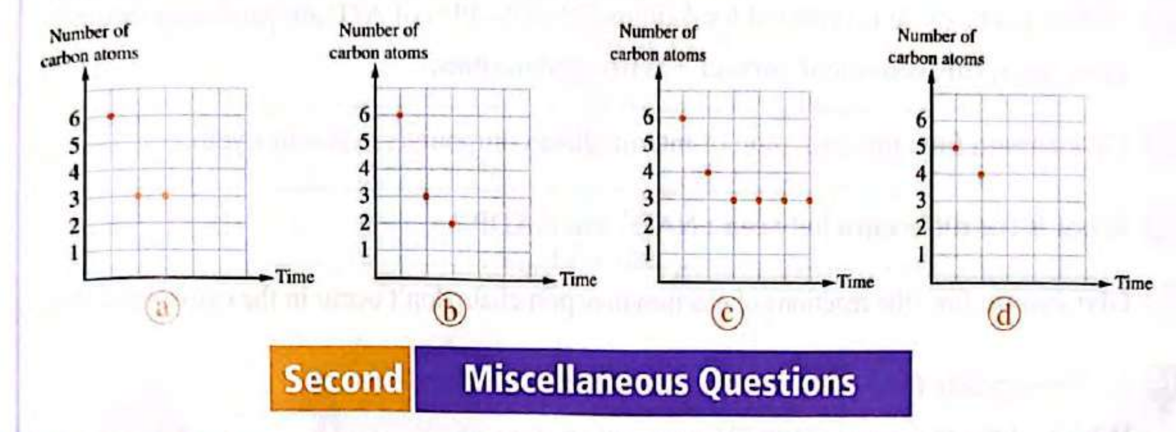
48 * What is the number of electrons that are transferred by NADH molecule to the cytochrome ?

ⓐ 1
ⓑ 2
ⓒ 3
ⓓ 4

49 * What is the number of ATP molecules that are resulted from the complete oxidation of one molecule of pyruvic acid ?

ⓐ 6
ⓑ 15
ⓒ 36
ⓓ 38

50 * Which of the following graphs expresses the reactions that are occurred to a glucose molecule in a muscle cell during anaerobic respiration ?



Second Miscellaneous Questions

1 **Give reason for :** on illustrating the mechanism of cellular respiration, food is expressed by a glucose molecule not by a fructose molecule.

2 **Explain :** the cellular respiration is different from the burning process.

3 **Give reason for :** ATP molecules are considered a temporary store for energy inside the cell.

4 "The structure of ATP molecules helps them in performing their function". **How far is this statement correct ? With explanation.**

5 **Give reason for :** glycolysis occurs in the aerobic and anaerobic respirations.

6 "The cell may use protein as a source to produce energy". **How far is this statement correct ? With explanation.**

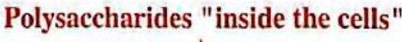
7 **What happens in case of :** the absence of coenzyme (A) from the cells of a living organism ?

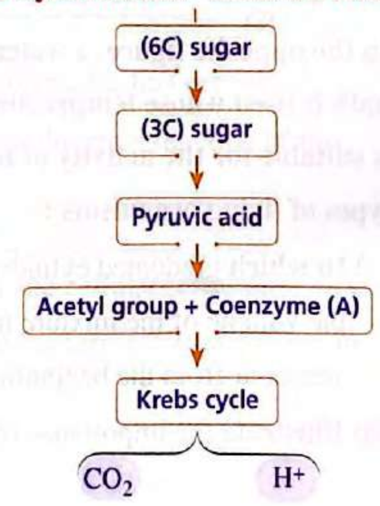
8 **In the opposite diagram :**

(a) **Mention** the two types of carbohydrates that are stored inside the plant and animal cells.

(b) **What** is the name of the process in which (6C) sugar is converted into pyruvic acid ? **And where** does it occur in the cell ?

(c) **What happens** to the resulted hydrogen ions ?





9 **Write the number that indicates :** the number of coenzymes that are resulted in one Krebs cycle.

10 "When Krebs cycle is repeated for 4 times, 20 molecules of ATP are produced directly". **How far is this statement correct ? With explanation.**

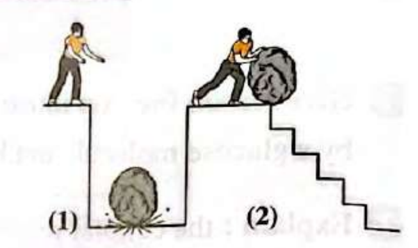
11 **Give reason for :** the formation of intermediate compounds in Krebs cycle.

12 **What is the difference between :** NAD^+ and NADP ?

13 **Give reason for :** the reactions of electron transport chain don't occur in the cytosole of the cell.

14 **In the opposite figure :**

Which of the two cases (1) or (2) represents a stage of the aerobic respiration in the cell ? **Explain your answer.**



15 **What is the similarity between :** NAD^+ and FAD ?

16 "The oxidation of 3 molecules of glucose during the electron transport chain produces 114 molecules of ATP". **How far is this statement correct ? With explanation.**

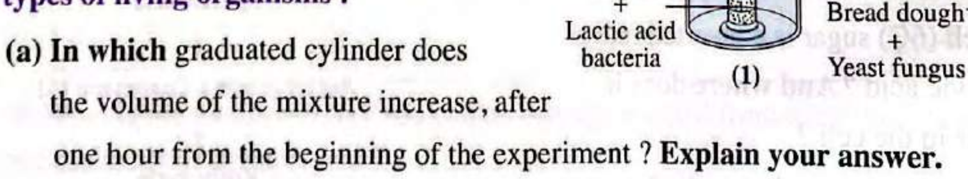
17 **Explain :** the shortage of oxygen doesn't affect the life of some living organisms.

18 **Write the number that indicates :** the number of lactic acid molecules that are resulted from one molecule of glucose in the anaerobic respiration.

19 **Explain :** the aerobic respiration could occur without forming the pyruvic acid.

20 **What happens in case of :** the exposure of some types of bacteria to a lack or absence of oxygen ?

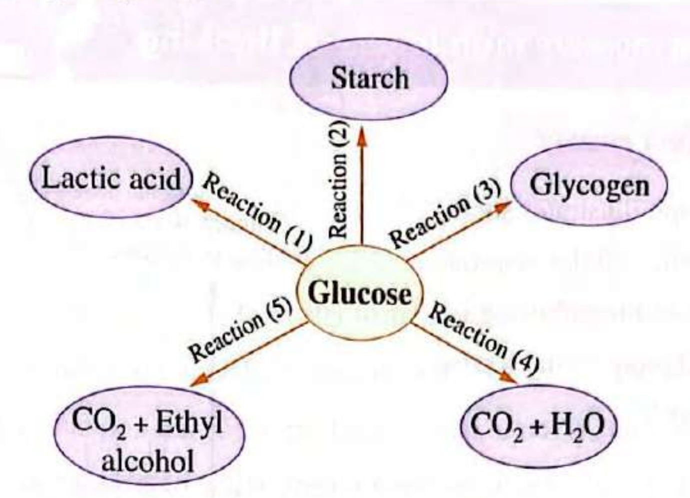
21 **In the opposite figure, a water bath is used whose temperature is suitable for the activity of both types of living organisms :**



(a) **In which** graduated cylinder does the volume of the mixture increase, after one hour from the beginning of the experiment ? **Explain your answer.**

(b) **Illustrate** the importance of using each of them in our daily life.

22 **From the following diagram :**



Which of the reactions from no. (1) : (5) represents :

(a) Aerobic respiration.

(b) A change that occurs inside the liver.

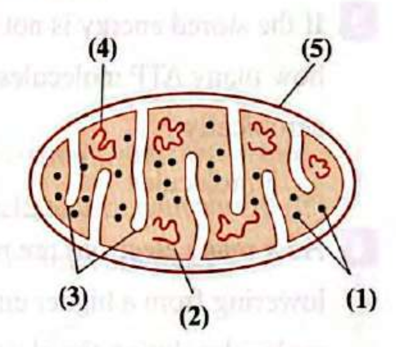
(c) Anaerobic respiration in muscles.

(d) Anaerobic respiration in yeast.

(e) A reaction that forms an organic substance inside the plant (in storage sites).

23 **Explain :** a diluted sugar solution is used during the alcoholic fermentation experiment.

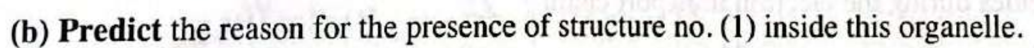
24 **The opposite figure shows one of the living organelles inside the cell :**



(a) Mention the number and name of the structure that :

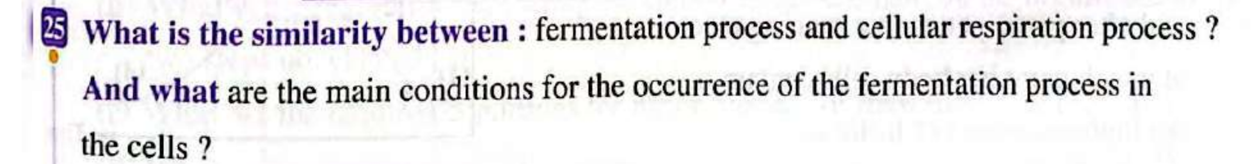
1. Contains the electron carriers.

2. Is present inside the cell nucleus.

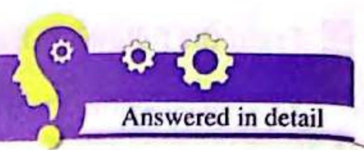


(b) Predict the reason for the presence of structure no. (1) inside this organelle.

(c) What is the relation between the structure no. (3) and the main function of this organelle ?



25 **What is the similarity between :** fermentation process and cellular respiration process ? **And what** are the main conditions for the occurrence of the fermentation process in the cells ?

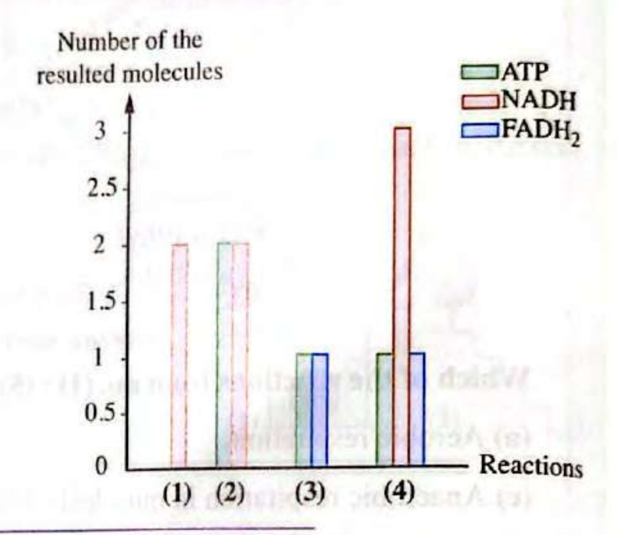


Questions that measure **high levels of thinking**

Answered in detail

Choose the correct answer :

1 The opposite graph illustrates some products of aerobic cellular respiration reactions, which of the following is formed during glycolysis and Krebs cycle respectively ?



ⓐ (1) and (3).
ⓑ (2) and (4).
ⓒ (1) and (4).
ⓓ (4) and (3).

2 What is the number of ATP molecules that are resulted indirectly from the conversion of a molecule of pyruvic acid into acetyl group ?

ⓐ Zero. ⓑ 2 ⓒ 3 ⓓ 6

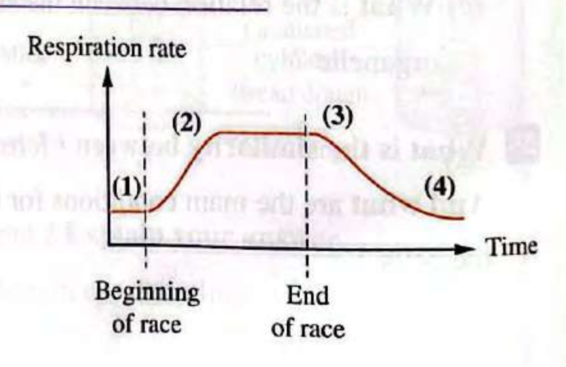
3 If the stored energy is not liberated from coenzymes during the electron transport chain, how many ATP molecules are resulted from the oxidation of one glucose molecule aerobically ?

ⓐ 3 molecules. ⓑ 4 molecules. ⓒ 8 molecules. ⓓ 16 molecules.

4 How many electrons are removed from one glucose molecule that contribute by their lowering from a higher energy level into a lower energy level in the production of ATP molecules during the electron transport chain ?

ⓐ 12 ⓑ 24 ⓒ 36 ⓓ 38

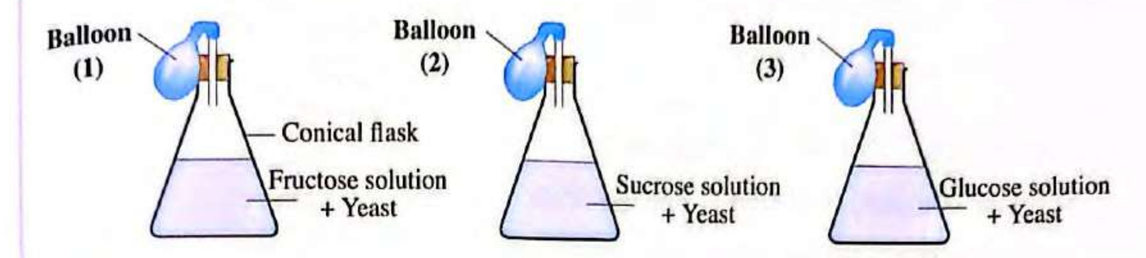
5 The opposite graph illustrates the respiration rate of a player before, during and after participating in a running race, at which point her body cells contain the highest amount of lactic acid ?



ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).



6 From the following figures, what can we observe after few hours ?



ⓐ The volume of balloon no. (1) is greater than that of no. (2) and less than that of no. (3).

ⓑ The volume of balloon no. (2) is greater than that of no. (1) and (3).

ⓒ The volume of balloon no. (3) is greater than that of no. (1) and (2).

ⓓ The volume of balloon no. (1) is greater than that of no. (2) and (3).

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7 How far are these statements "the aerobic respiration may occur and followed by anaerobic respiration", "the anaerobic respiration may occur and followed by aerobic respiration" correct ?

ⓐ The first statement is correct and the second statement is wrong.

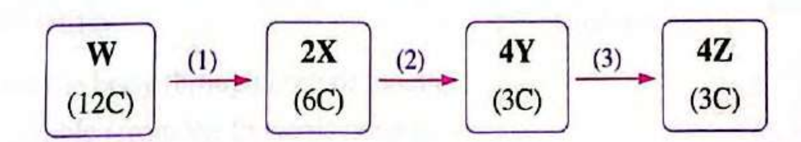
ⓑ The first statement is wrong and the second statement is correct.

ⓒ The two statements are correct.

ⓓ The two statements are wrong.

Answer the following questions :

8 **In the following diagram, process no. (1) occurs inside the small intestine, while the two processes no. (2) and (3) occur inside the living cell, where compound (Z) increases, when feeling the muscular fatigue, in the light of this, answer :**



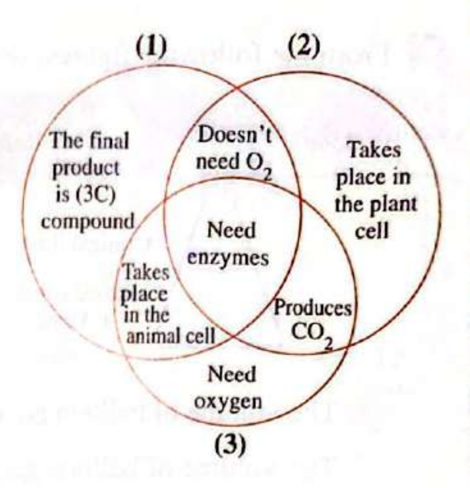
(a) What are the compounds from (W) : (Z) ? **And what** are the processes from no. (1) : (3) ?

(b) What is the reason for decreasing the carbon atoms into half, on the occurrence of the two steps no. (1) and (2) ?

(c) What are the required conditions for the occurrence of steps from no. (1) : (3) ?

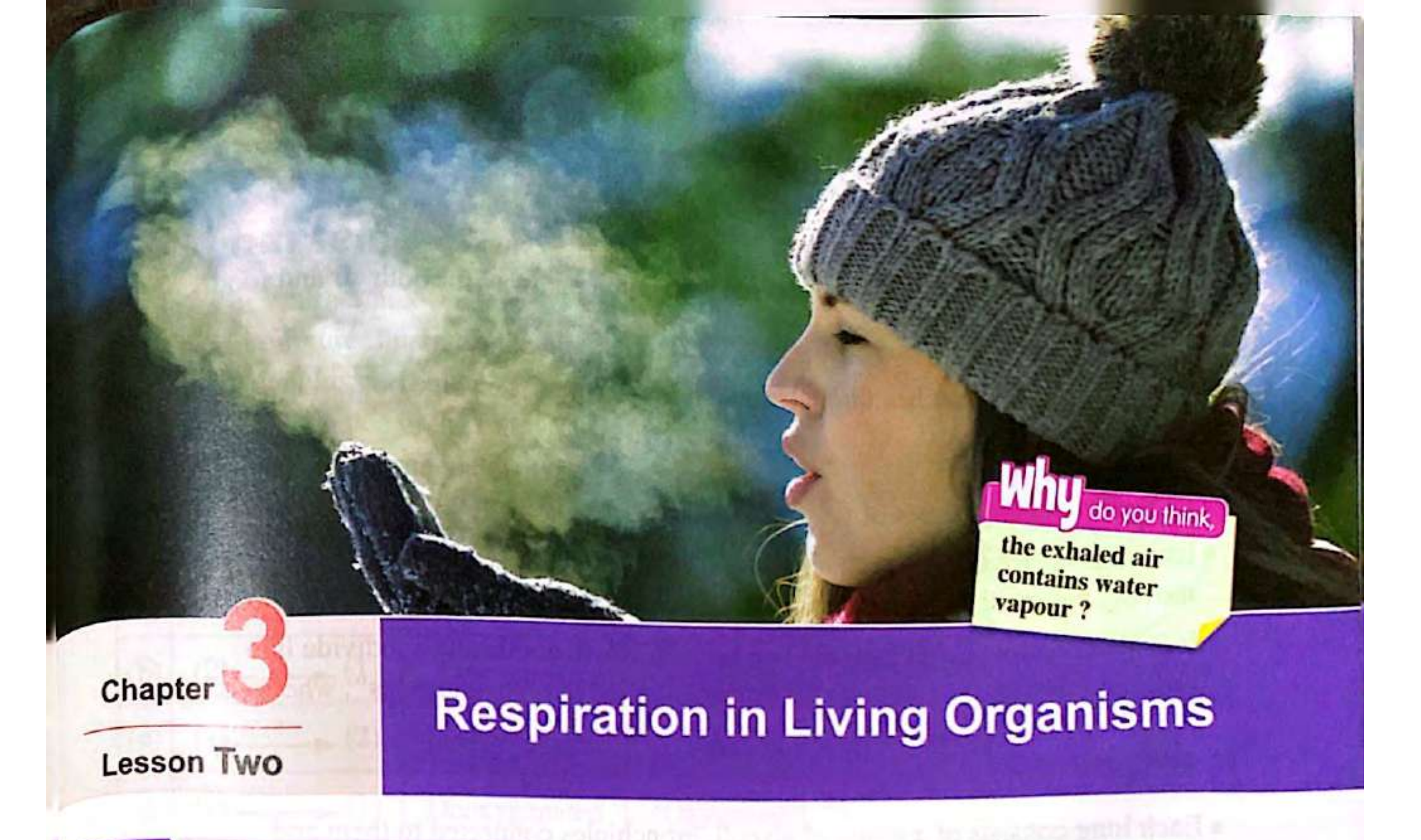
(d) What is the number of ATP molecules that are resulted from one molecule of (W) through these processes ?

9 **The opposite figure illustrates some vital processes that occur in the cells of living organisms, examine it, then answer :**



(a) How many ATP molecules are produced from the complete oxidation of one molecule of glucose in process no. (3) ?

(b) Arrange the processes from (1) : (3) descendingly, according to their energy production.



Chapter 3

Lesson Two

Respiration in Living Organisms

First Respiration in man

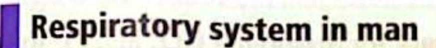


- Human body contains a system that extracts the oxygen from the atmospheric air, then transfers it to the blood which delivers it to the body cells. This system is called **"respiratory system"**.

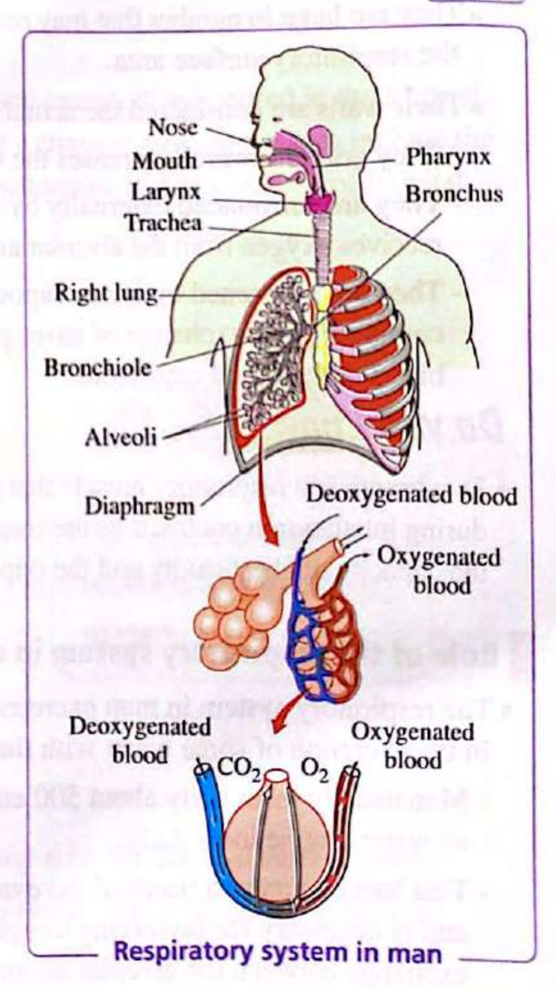
Respiratory system in man

- It consists of many organs, where each one of them is suitable for performing its function, as follows :

1 Nose or mouth



- The air enters the body through nose or mouth, but it is preferable (from the hygienic point of view) to enter through nose, **because :**
  - It is a warm passage, as it is lined with numerous blood capillaries.
  - It is moist, as it secretes mucus.
  - It serves as a filter, because it contains mucus and hairs which act as filters (sieves).



Respiratory system in man

2 Pharynx

- Air passes through it and is considered a common pathway for both air and food.

3 Larynx

- The air enters the trachea through it and it is known as **the voice box**.

4 Trachea

- Its walls contain a series of $(\frac{3}{4})$ cartilaginous rings to keep it permenantly opened.
- Its inner surface is lined with cilia which beat upwards to filter the air passed through it by moving the small foreign bodies to the pharynx, so that they may be swallowed.
- It is divided at its lower end into two bronchi which divide and subdivide into progressively smaller and smaller branches called the "**bronchioles**", where each bronchiole finally ends with sacs called the "**alveoli**".

5 Lungs

- Each lung consists of a group of alveoli, bronchioles connected to them and the surrounding blood capillaries.
- **Functional suitability of alveoli :**
  - They are large in number that may reach about 600 million alveoli per lung to increase the respiratory surface area.
  - Their walls are considered the actual respiratory surface, **because :**
    - They are thin, which increases the speed of gas exchanging process.
    - They are surrounded externally by a large network of blood capillaries whose blood receives oxygen from the alveolar air and from the bronchioles that are connected to them.
    - They are moistened by water vapour which is necessary for dissolving CO_2 and O_2 for completing the exchange of gases process between the alveolar air and the surrounding blood in the blood capillaries.

Do you know... ?

- Diaphragm is a respiratory muscle that participates mainly in the respiration mechanism, during inhalation it contracts as the muscles among the ribs contract to increase the capacity of chest cavity and the opposite occurs during exhalation.

Role of the respiratory system in excretion process

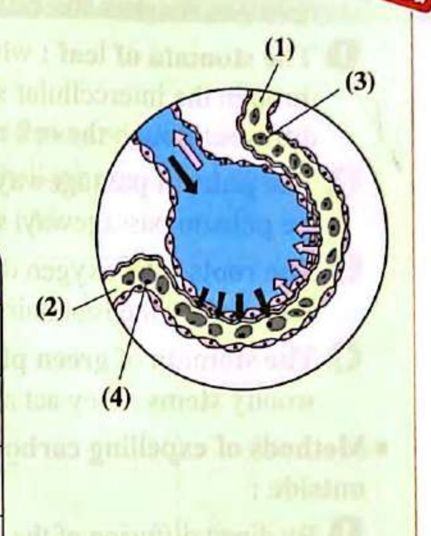
- The respiratory system in man excretes carbon dioxide, as well as it has an important role in the excretion of some water with the exhaled air in the form of water vapour, **where :**
  - Man usually loses daily about 500 cm^3 of water through the two lungs out of 2500 cm^3 of water that he loses daily.
  - This loss occurs as a result of the evaporation of water that moistens the alveolar walls and is necessary for dissolving oxygen and carbon dioxide to complete the gaseous exchange between the alveolar air and the surrounding blood in the blood capillaries.

Test yourself

Answered

Choose the correct answer :

The opposite figure illustrates the blood route around an alveolus during the gas exchange process, which choice in the following table illustrates the blood route and its type ?

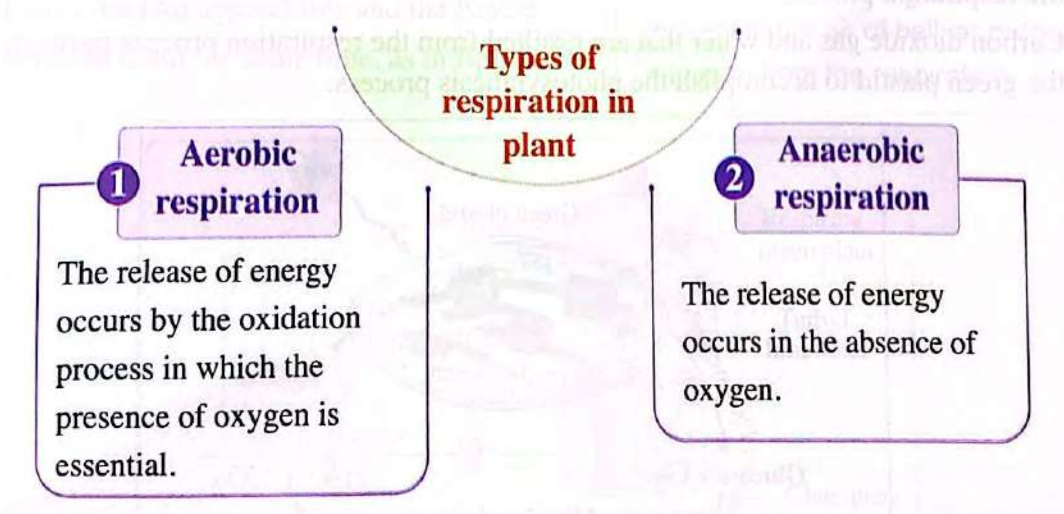


	Blood route	Blood at (3)	Blood at (4)
ⓐ	(1) ——▶ (2)	Oxygenated	Deoxygenated
ⓑ	(2) ——▶ (1)	Oxygenated	Deoxygenated
ⓒ	(1) ——▶ (2)	Deoxygenated	Oxygenated
ⓓ	(2) ——▶ (1)	Deoxygenated	Oxygenated

Second Respiration in plant

Respiration process in plant :

It is a process in which the plant obtains the chemical energy that is stored in the form of organic molecules rich in energy (glucose) through a chain of reactions which include the breaking down of the carbon bonds in the organic substance to carry out one of its vital activities.



Respiration in most plants

- In most plants, each living cell is in a direct contact with the external environment, therefore the gaseous exchange process is easy to occur, where oxygen gas diffuses inside the cell, while carbon dioxide gas diffuses outside the cell.

Respiration in vascular plants

- **Oxygen gas reaches the cells through various passageways, such as :**

  1. **The stomata of leaf :** when they open, air enters into the air chambers and diffuses through the intercellular spaces that spread in various parts of the plant. So, the gas diffuses through the cell membranes and dissolves in the cell water.
  2. **The phloem passageways :** some of the oxygen dissolved in water is carried to the phloem passageway, so that it reaches the tissues of the stem and root.
  3. **The roots :** the oxygen dissolved in the soil water enters the plant through them as it is absorbed by the root hairs or imbibed by the root cell walls.
  4. **The stomata of green plant stem and the lenticels or any cracks in the bark of woody stems :** they act as an entrance for air.

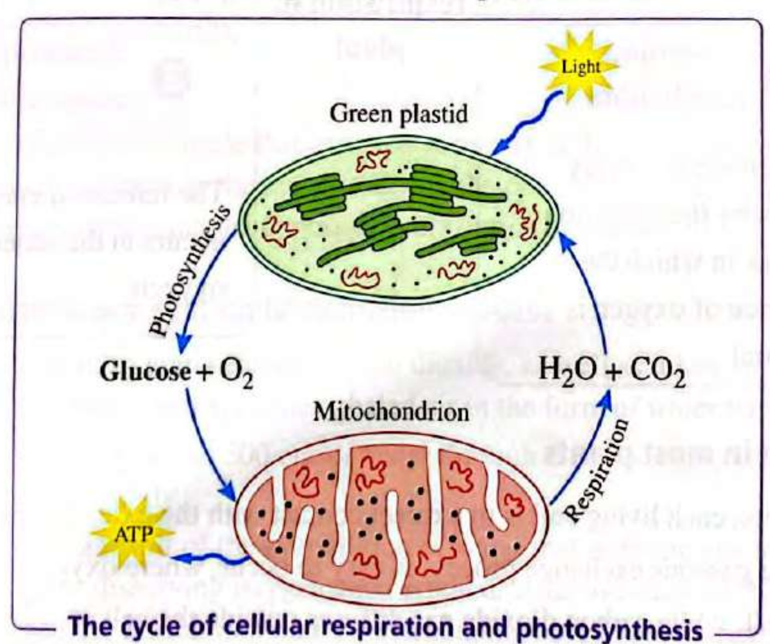
- **Methods of expelling carbon dioxide gas (that is produced from the respiration) to outside :**

  1. By direct diffusion of the gas from the plant cells to the external environment, and this occurs in the cells which are on the surface, where they are exposed directly to air or soil.
  2. For deep seated cells, carbon dioxide gas passes to the xylem or phloem tissues, then to the stomata and to the external environment.

The relation between photosynthesis and respiration processes in the plant

- **What happens in the chloroplast is reversed in the mitochondria, where :**

  - The green plastids of the green plants perform the photosynthesis process, producing glucose and oxygen gas.
  - Glucose and oxygen gas move to the mitochondria to release the energy through the respiration process.
  - Carbon dioxide gas and water that are resulted from the respiration process move to the green plastid to accomplish the photosynthesis process.



The cycle of cellular respiration and photosynthesis



Experiment — Respiration in green plant parts

1. Steps :

(1) Bring a green potted plant and place it on a glass plate and put a small beaker containing clear limewater next to it, then invert a glass bell jar over them, then cover the bell jar with a black piece of cloth, as in **figure (A)**.

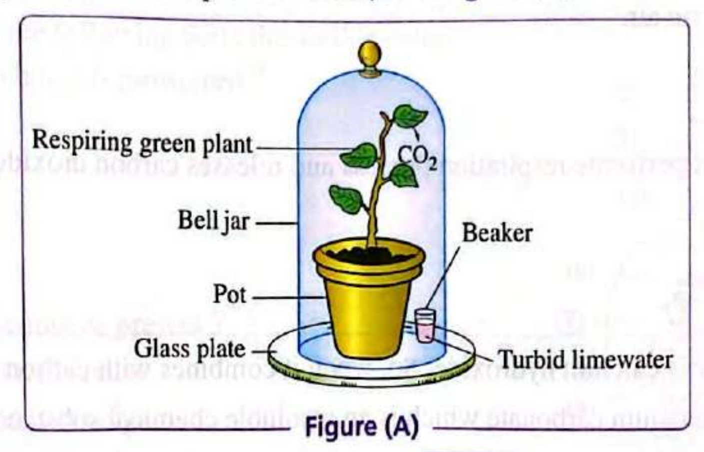


Figure (A)

(2) Prepare a similar apparatus with a pot that is empty of any cultivated plant.

(3) Put some clear limewater in another small beaker.

(4) Leave the two apparatuses and the beaker between them for some time, as in **figure (B)**.

Note

The bell jar is covered by a black piece of cloth, in order to keep the light away from the green plant and stop the photosynthesis process which consumes CO_2 that is present in the air of bell jar or that released from the respiration.

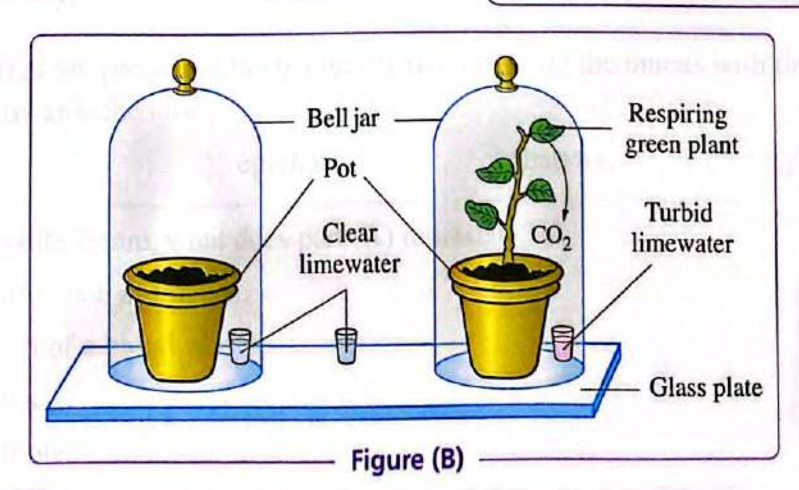


Figure (B)

2. Observation :

Limewater becomes turbid in step no. (1) only, and it doesn't become turbid in steps no. (2) and no. (3).

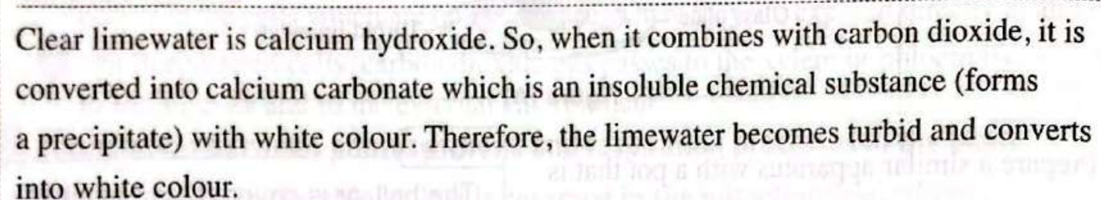
3. Explanations :

- In step no. (1), the green plant respires and produces carbon dioxide gas which caused the turbidity of limewater in the beaker.
- In steps no. (2) and no. (3), the limewater in the other two beakers shows no turbidity, due to the small percentage of carbon dioxide gas, either in the air of the bell jar or in the atmospheric air.

4. Conclusion :

The green plant performs respiration process and releases carbon dioxide gas, as a result of this process.

Remember that



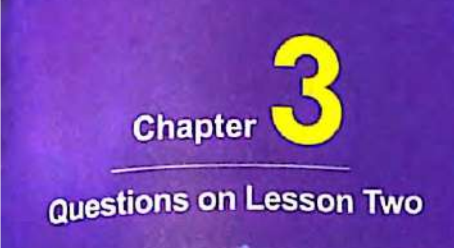
Clear limewater is calcium hydroxide. So, when it combines with carbon dioxide, it is converted into calcium carbonate which is an insoluble chemical substance (forms a precipitate) with white colour. Therefore, the limewater becomes turbid and converts into white colour.

2 *Test yourself*

Answered

Determine a similarity between : mitochondrion and green plastid.

....



Respiration in Living Organisms





● Understand ○ Apply ● Analyze





Multiple Choice Questions

1 In the opposite figure :

(1) In which of the following parts the air that enters into the two lungs is moistened ?

ⓐ (1).
ⓑ (2).
ⓒ (3).
ⓓ (4).

(2) Where is the mucus present ?

ⓐ In part no. (1) only.
ⓑ In part no. (2) only.
ⓒ In part no. (7) only.
ⓓ In parts no. (2) and (7).

(3) What is the part that represents the voice box ?

ⓐ (3). ⓑ (4). ⓒ (5). ⓓ (7).

(4) Which of the following parts <u>doesn't</u> consist of cartilages in its structure ?

ⓐ (1). ⓑ (5). ⓒ (7). ⓓ (8).

(5) Which of the following parts is/are rich in blood capillaries ?

ⓐ (2) only. ⓑ (9) only. ⓒ (2) and (9). ⓓ (2) and (8).

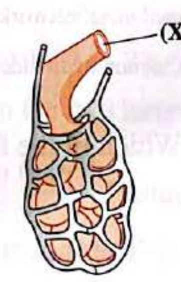
---

2 The cilia that are present in the trachea work on pushing the mucus with the minute dust particles towards the ....

ⓐ nose. ⓑ epiglottis. ⓒ pharynx. ⓓ two lungs.

---

3 In the opposite figure, what does part (X) represent ?



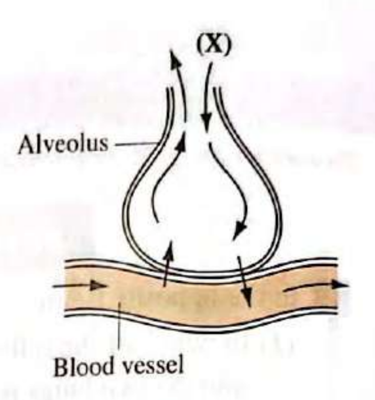
ⓐ A main branch of trachea.
ⓑ A branch of a blood vessel.
ⓒ Alveolus.
ⓓ Bronchiole.

---

4 Which of the following <u>isn't</u> performed by the respiratory tracts ?

ⓐ Filtering the air.
ⓑ Moistening the air.
ⓒ Exchanging gases.
ⓓ Warming the air.

5 In the opposite figure, which of the following factors acts on increasing the permeability rate of gas (X) from the alveolus to the blood vessel ?



a) The increase in its wall thickness.

b) The increase in its surface area.

c) The decrease in the concentration of gas (X) inside it.

d) The decrease in the concentration of water vapour inside it.

6 Which of the following doesn't/don't affect the rate and the depth of inhalation and exhalation ?

a) Physical exercises.

b) The percentage of each of oxygen and carbon dioxide in the atmospheric air.

c) Respiratory enzymes.

d) Psychological state.

7 Which of the following properties characterizes the alveoli ?

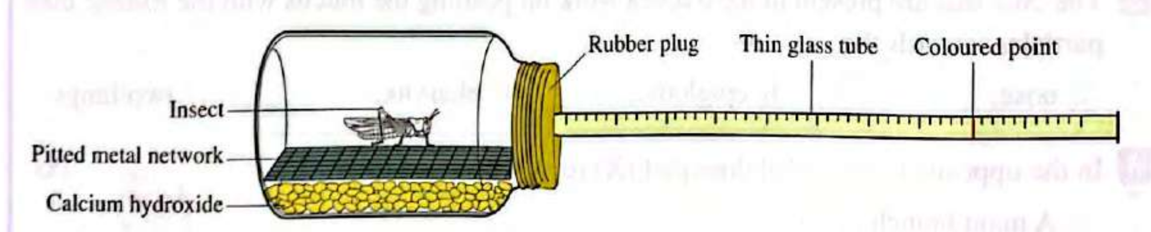
a) They are present in all animals.

b) They contain a high concentration of oxygen compared to the atmospheric air.

c) Their number is 600 millions in the two lungs.

d) They are surrounded by oxygenated and deoxygenated blood.

8 Study the following figure that illustrates an experiment for measuring a process that is performed by an insect putting inside a glass jar :



Which of the following can be measured by the coloured point movement inside the glass tube ?

a) The formation of lactic acid.

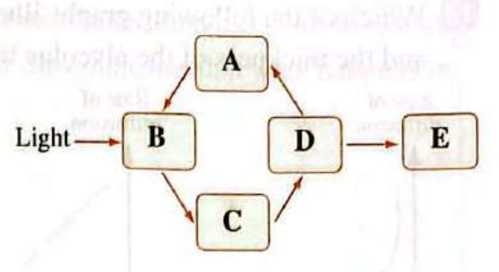
b) The increase in the metabolic rate.

c) The consumption of oxygen.

d) The release of energy.



9 The opposite figure illustrates one of the biological cycles that happen in the plant, if you know that letter (A) represents $CO_2 + H_2O$, what do letters (B, C, D and E) represent in the figure ?



	B	C	D	E
ⓐ	Chloroplast	ATP	Mitochondria	Glucose + O_2
ⓑ	Chloroplast	Glucose + O_2	Mitochondria	ATP
ⓒ	Mitochondria	Glucose + O_2	Chloroplast	ATP
ⓓ	Mitochondria	ATP	Chloroplast	Glucose + O_2

10 Which of the following statements **doesn't** agree with the respiration process ?

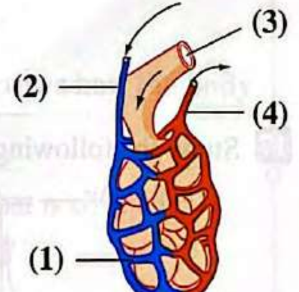
ⓐ All the living cells respire.

ⓑ An amount of sugar is released from it.

ⓒ Plants respire in day and night.

ⓓ Plants respire oxygen and release CO_2 gas.

11 From the opposite figure, which of the following structures contains the highest concentration of CO_2 gas ?



ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

12 Which of the following statements **doesn't** agree with the reason for the speed of gases exchange between the alveoli and the blood to the oxygen that is present in the two lungs ?

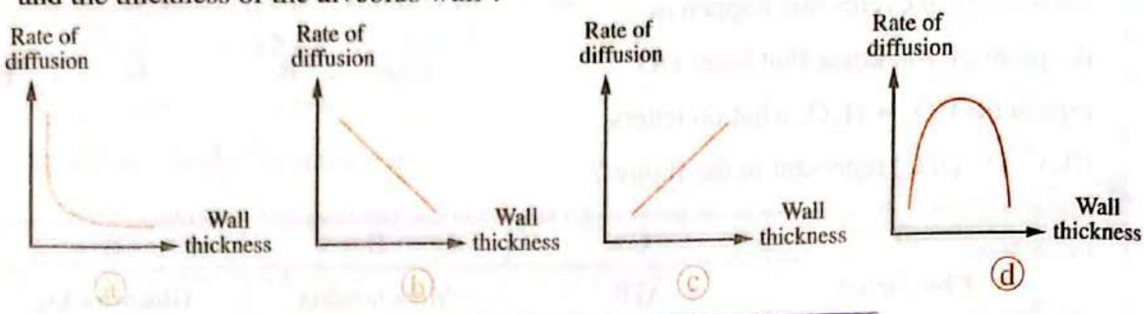
ⓐ The air that enters the two lungs contains a greater amount of oxygen than the air that comes out of them.

ⓑ The alveoli are surrounded by a huge network of blood capillaries.

ⓒ The wall of alveolus is thin and its surface area is large.

ⓓ The oxygen concentration in blood is less than its concentration in the alveoli.

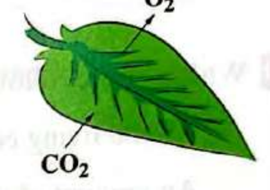
13 Which of the following graphs illustrates the relation between the rate of oxygen diffusion and the thickness of the alveolus wall ?



14 What are the main sites for exchanging gases in plant ?

(a) Leaves. (b) Lenticels. (c) Stomata. (d) Roots.

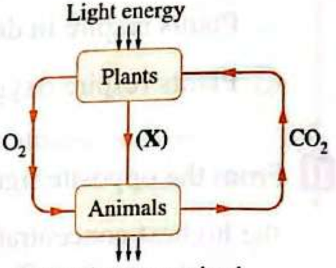
15 What is the vital process that is illustrated by the opposite figure in the plant ?



(a) Respiration. (b) Transpiration.

(c) Photosynthesis. (d) Transportation.

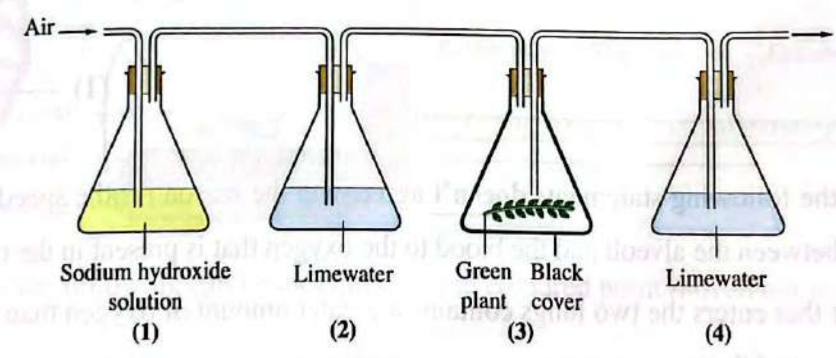
16 What are the molecules that are represented by letter (X) in the opposite diagram ?



(a) ATP (b) ADP

(c) $C_6H_{12}O_6$ (d) H_2O

17 Study the following figure, then determine :



Which of the following choices shows what happens to limewater in flasks no. (2) and (4) respectively after pumping air ?

(a) Becomes turbid / Becomes turbid. (b) Becomes turbid / Remains clear.

(c) Remains clear / Becomes turbid. (d) Remains clear / Remains clear.

18 ✱ The plant cell can form the high-energy organic compounds, then use them to extract the energy required for performing its vital functions, this indicates that what happens in the ....

ⓐ mitochondria is reversed in the chloroplast.
ⓑ chloroplast is reversed in the mitochondria.
ⓒ chloroplast is continued in the mitochondria.
ⓓ mitochondria is continued in the chloroplast.

19 ✱ Which of the following **doesn't** increase the rate of respiration spontaneously ?

ⓐ Increasing the pH value in blood.
ⓑ Increasing the carbon dioxide level in blood.
ⓒ Increasing the blood acidity.
ⓓ Decreasing the haemoglobin level in the red blood corpuscles.

Second Miscellaneous Questions

1 **What happens in case of :** the nose is devoid of hairs and mucus ?

2 "If you know that bronchi contain cilia". **Deduce the function of these cilia.**

3 **What happens if :** the trachea is devoid of cartilaginous rings that are present in its walls ?

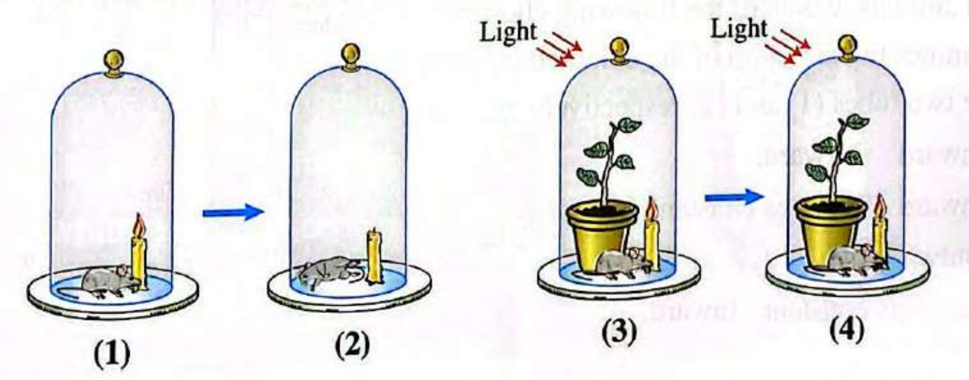
4 **Give reason for :** the presence of millions of alveoli in one lung.

5 **What happens in case of :** increasing the thickness of alveoli walls ?

6 **Where** is the carbon dioxide formed in mammals ? **Illustrate by arrows how the body gets rid of it.**

7 **What happens in case of :** putting a growing plant in a glass box that is covered by a black cover and devoid of oxygen then leaving it for several days ?

8 **From the following figures, explain why** the mouse died and the candle burnt out in figure no. (2), **and why** the mouse lived and the candle remained illuminated in figure no. (4).

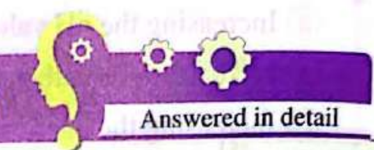


9 **Follow by arrows the steps of the arrival of an oxygen molecule to each of the following :**

(a) Cells of skin epidermis. (b) Cells of plant stem epidermis.

10 **What happens in case of :** uncovering the bell jar with a piece of black cloth in the experiment that proves the respiration of the green plant parts ?

11 "Fish in their farms need a sufficient amount of dissolved oxygen to cover their respiration needs". **Suggest several natural methods to decrease the need to pump oxygen in the fish farms.**

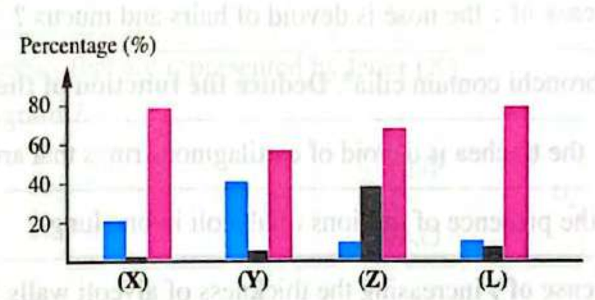


Questions that measure **high levels of thinking**

Answered in detail

Choose the correct answer :

1 From the following graph :



(1) Which of the following samples represents the air entering into the two lungs ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

(2) Which of the following samples represents the air coming out from the two lungs ?

ⓐ (X). ⓑ (Y). ⓒ (Z). ⓓ (L).

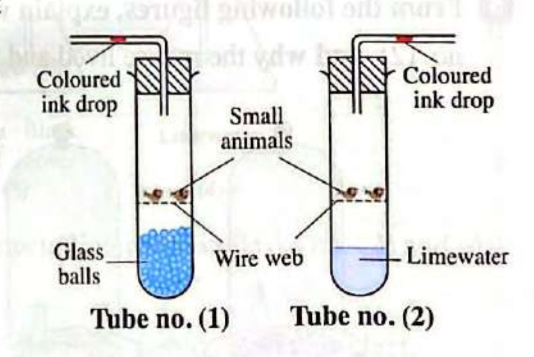
2 The two opposite figures illustrate an experiment to measure the rate of respiration in some small animals, which of the following choices determines the direction of the coloured ink drop in the two tubes (1) and (2) respectively ?

ⓐ Inward / Outward.

ⓑ Inward / Remains constant.

ⓒ Outward / Inward.

ⓓ Remains constant / Inward.

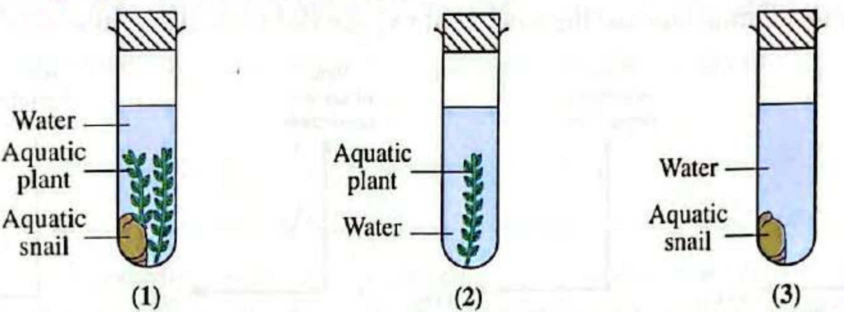


3 In the human lungs, CO_2 and O_2 gases move through the plasma membranes of the cells, how many plasma membranes through which oxygen spreads from the atmospheric air and CO_2 spreads to the atmospheric air respectively ?

ⓐ 3 / 2 ⓑ 3 / 4 ⓒ 4 / 2 ⓓ 5 / 5

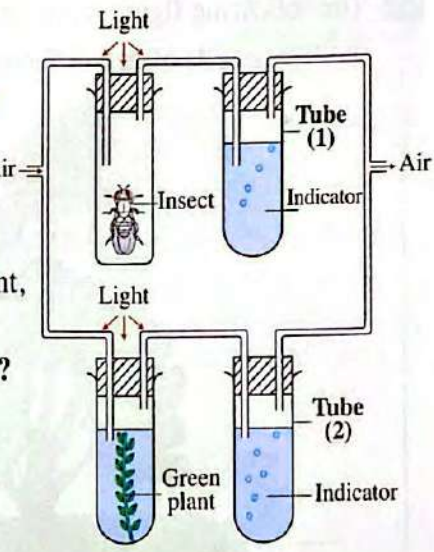
Answer the following questions :

4 **The following figures illustrate three test tubes :**



In which of the previous tubes the water should be changed faster to keep the animal alive ? **Explain your answer.**

5 **Study well the opposite figure that represents an experiment to compare between the amount of carbon dioxide that resulted from the respiration of an insect and an aquatic green plant, then answer :**



(a) **What** is the name of the substance that is used in detecting CO_2 ?

(b) After one hour from the beginning of the experiment, the indicator doesn't change in tube no. (2), but it changes in tube no (1). **What is your explanation ?**

(c) **What** do you expect to happen, on putting the apparatus in darkness for a long time ?

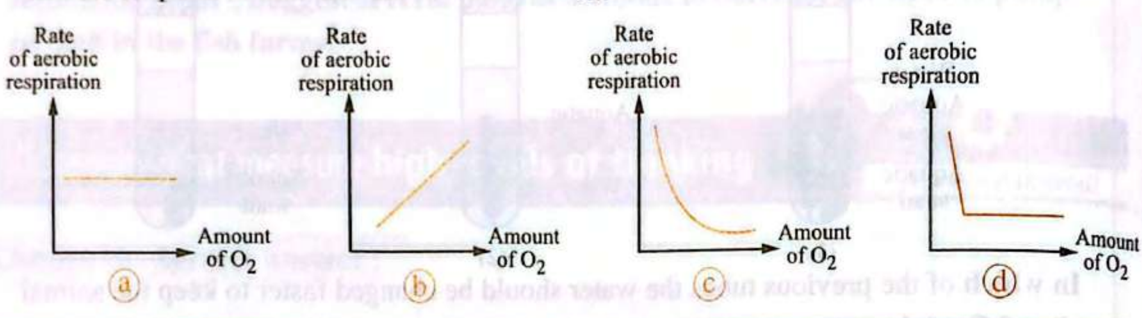


Test on Chapter 3

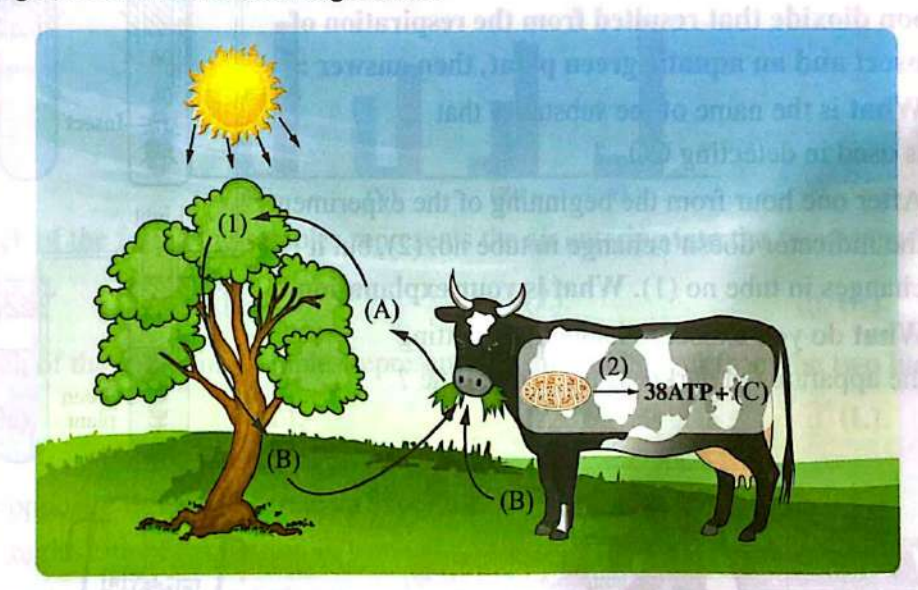
Respiration in Living Organisms

Choose the correct answer (1 : 20) :

1 Which of the following graphs expresses the relation between the efficiency of the aerobic respiration rate and the amount of oxygen that is available in a muscular cell ?



2 The following figure represents two vital processes (1) and (2) that occur inside the living cells of two different organisms :



Which of the following can be concluded from the two processes (1) and (2) ?

ⓐ Process no. (2) depends on process no. (1).

ⓑ Process no. (1) depends on process no. (2).

ⓒ No one of them depends on the other.

ⓓ Each of them depends on the other.

3 Which of the following are used by the cell as a rapid source to obtain energy ?

ⓐ Glucose molecules.

ⓑ Phosphoglyceraldehyde molecules.

ⓒ Pyruvic acid molecules.

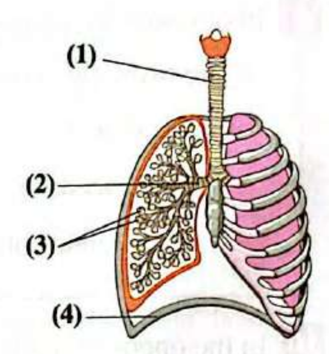
ⓓ ATP molecules.

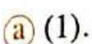
4 What is the ratio of the number of $FADH_2$ to NADH molecules that are resulted from the complete oxidation of one molecule of glucose in aerobic conditions ?

ⓐ 1 : 5 ⓑ 3 : 1

ⓒ 5 : 1 ⓓ 1 : 3

5 The opposite figure illustrates the respiratory system in human, which of the following represents the functional units of this system ?




ⓐ (1).

ⓑ (2).

ⓒ (3).

ⓓ (4).

6 The following table represents 3 different stages for the oxidation of glucose molecule inside the living cell :

Stage (1)	Needs the presence of ATP molecules and occurs in the absence of oxygen.
Stage (2)	Needs the presence of oxygen and occurs in the absence of ATP molecules.
Stage (3)	Doesn't need the presence of ATP molecules or oxygen.

Which of the following represents the three stages (1), (2) and (3) respectively ?

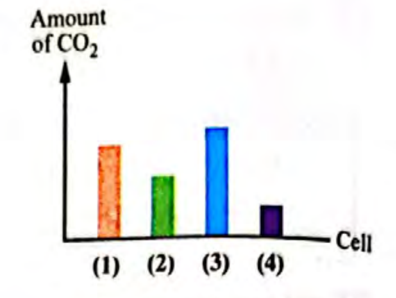
ⓐ Glycolysis – Krebs cycle – Electron transport chain.

ⓑ Krebs cycle – Glycolysis – Electron transport chain.

ⓒ Electron transport chain – Krebs cycle – Glycolysis.

ⓓ Glycolysis – Electron transport chain – Krebs cycle.

7 The opposite graph represents the amount of CO_2 gas that is resulted from four cells (1), (2), (3) and (4) at the same period of time, which of the following represents the most active cell ?



ⓐ Cell no. (1).　ⓑ Cell no. (2).
ⓒ Cell no. (3).　ⓓ Cell no. (4).

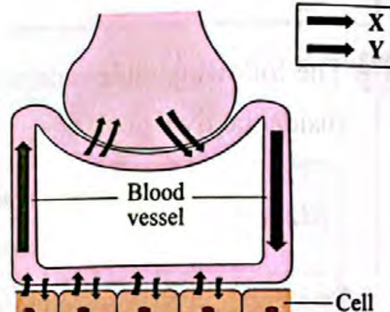
8 Which of the following **don't** share in the arrival of oxygen gas to the cells of the herbaceous plant stems ?

ⓐ Phloem passageways.　ⓑ Stomata.　ⓒ Lenticels.　ⓓ Roots.

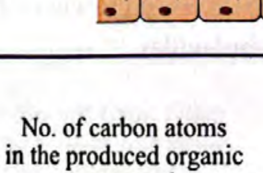
9 Photosynthetic phosphorylation and oxidative phosphorylation, ...

ⓐ are reversible processes.
ⓑ the first occurs in the mitochondria and the second occurs in the chloroplast.
ⓒ the first needs energy and the second releases energy.
ⓓ have different source of energy.

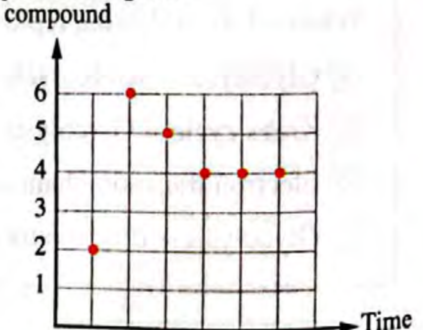
10 In the opposite figure, what are the two gases that are represented by the symbols (X) and (Y) respectively ?



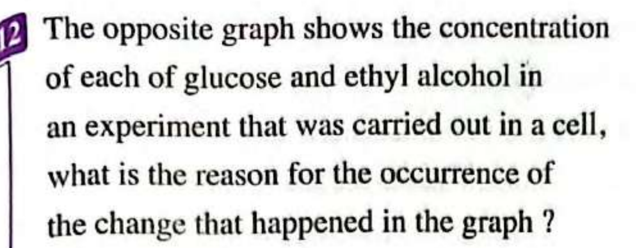
ⓐ CO_2 and O_2
ⓑ O_2 and CO_2
ⓒ CO_2 and N_2
ⓓ N_2 and O_2



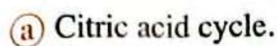
11 The opposite graph represents the produced organic compounds during a stage of cellular respiration, what is the number of ATP molecules that produced directly during this stage ?

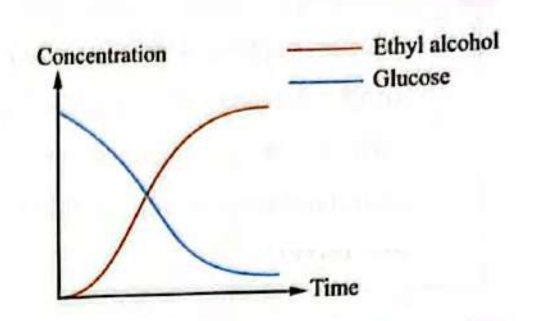


ⓐ One molecule.
ⓑ 2 molecules.
ⓒ 3 molecules.
ⓓ 12 molecules.



12 The opposite graph shows the concentration of each of glucose and ethyl alcohol in an experiment that was carried out in a cell, what is the reason for the occurrence of the change that happened in the graph ?





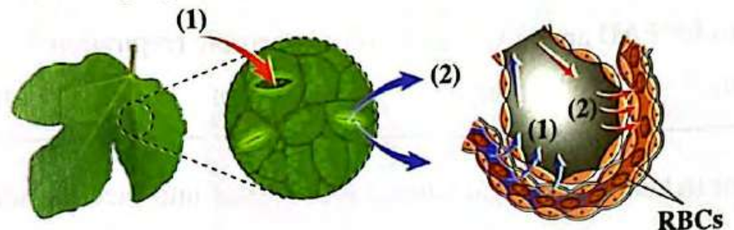
ⓐ Citric acid cycle.

ⓑ Pyruvic acid reduction.

ⓒ Lactic acid fermentation.

ⓓ Glycolysis.

13 Study the two following figures, then conclude :



What do arrows no. (1) and no. (2) represent respectively ?

ⓐ Carbon dioxide / Oxygen.

ⓑ Water vapour / Carbon dioxide.

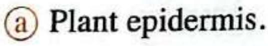
ⓒ Oxygen / Water vapour.

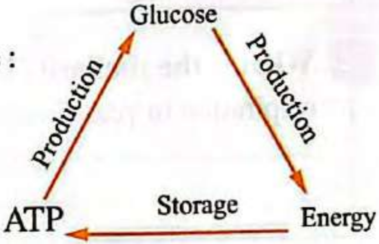
ⓓ Oxygen / Carbon dioxide.

14 What is the compound used in the aerobic and anaerobic respirations ?

ⓐ CoA ⓑ FAD ⓒ NAD^+ ⓓ NADP

15 Study the opposite diagram which represents two vital processes that occur in the living organisms, then determine : In which type of cells do these processes take place ?





ⓐ Plant epidermis.

ⓑ Companion cell.

ⓒ Spongy layer.

ⓓ Xylem parenchyma.

16 Both of mitochondria cristae and chloroplast membranes contain a system for ....

ⓐ enzymes synthesis.

ⓑ PGAL production.

ⓒ electron transport.

ⓓ glucose formation.

17 Human and plant, according to the respiration process, are ....

(a) similar, because both have similar cellular enzymes.

(b) similar, because both respire without the need for atmospheric air.

(c) different, because respiration is aerobic in human and anaerobic in plant.

(d) different, because human exhales CO_2 as a product, while plant produces O_2 as a product.

18 What is the number of reduced coenzymes during the oxidation of acetyl molecule aerobically ?

(a) 3 (b) 4 (c) 5 (d) 10

19 What happens for FAD and NAD^+ molecules in aerobic respiration ?

(a) Oxidation. (b) Reduction. (c) Hydration. (d) Decomposition.

20 What happens to ketoglutaric acid when it is converted into succinic acid during cellular respiration ?

(a) It combines with O_2

(b) It consumes ATP molecules.

(c) It consumes CO_2

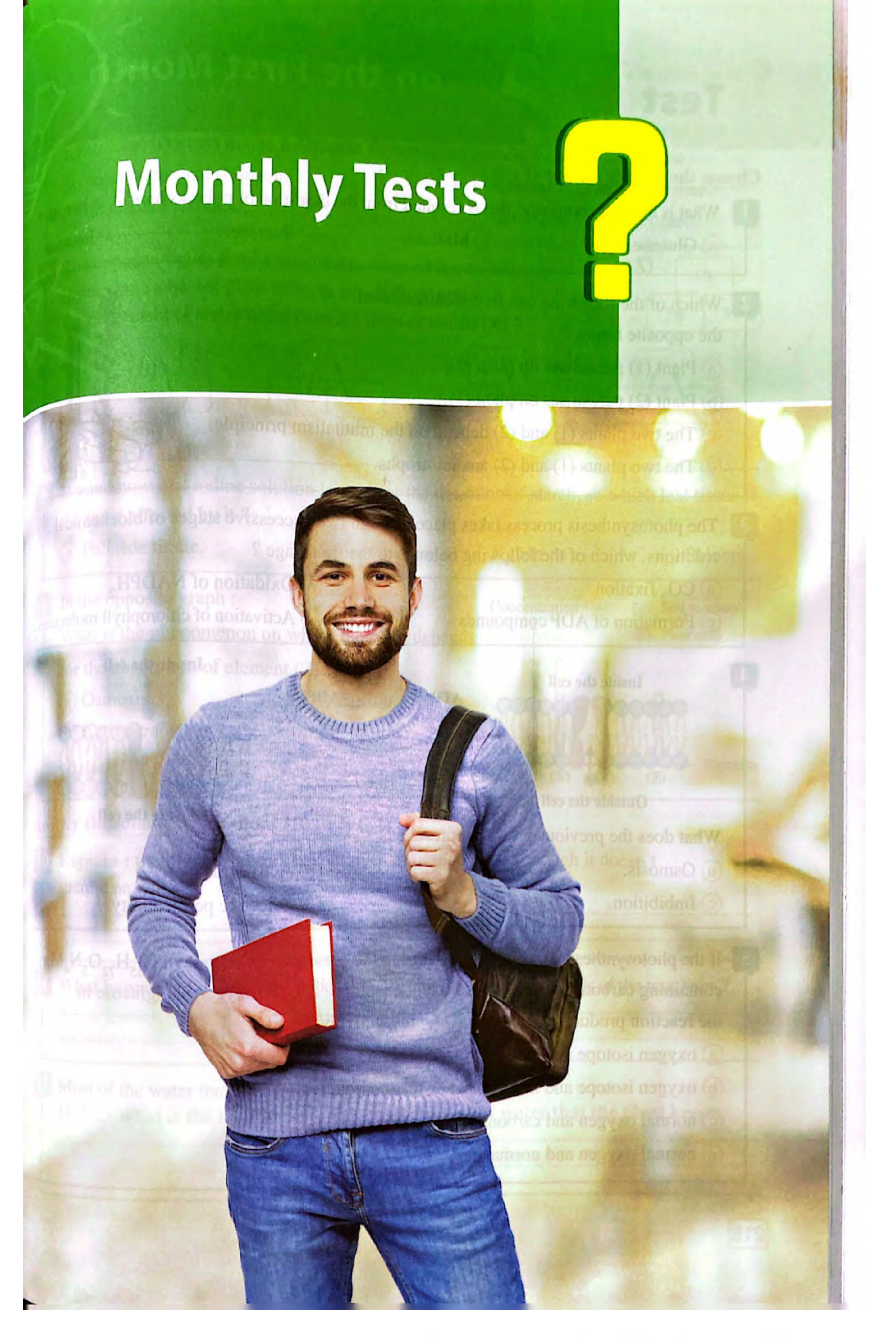
(d) It loses electrons.

Answer the following questions (21 : 23) :

21 **What happens in case of :** the human respires polluted air with dust ?

22 **What is the similarity between :** the anaerobic respiration in bacteria and anaerobic respiration in yeast fungus ?

23 "The human respiratory system has no role in the excretion of water from the body". **How far is this statement correct ? With explanation.**


Monthly Tests

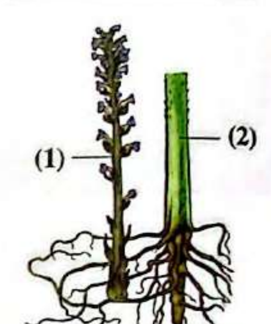
Test 1 on the First Month

Choose the correct answer (1 : 9) :

1 What is the first compound that is resulted from the digestion of polysaccharides in human ?

(a) Glucose. (b) Maltose. (c) Sucrose. (d) Lactose.

2 Which of the following can be concluded from the opposite figure ?



(a) Plant (1) parasitises on plant (2).

(b) Plant (2) parasitises on plant (1).

(c) The two plants (1) and (2) depend on the mutualism principle.

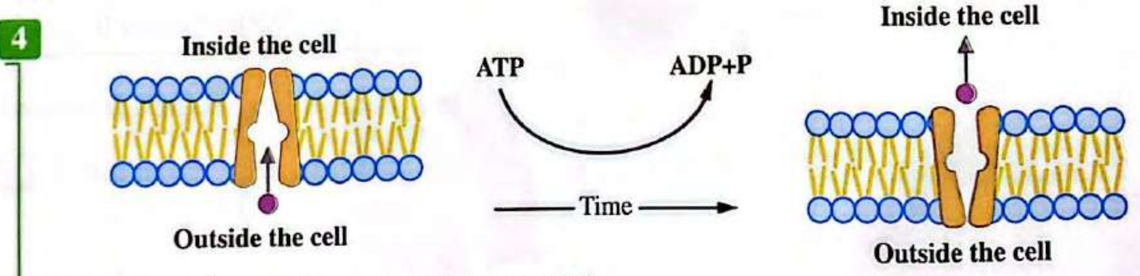
(d) The two plants (1) and (2) are autotrophs.

3 The photosynthesis process takes place through two successive stages of biochemical reactions, which of the following belongs to the first stage ?

(a) CO_2 fixation. (b) Oxidation of $NADPH_2$

(c) Formation of ADP compounds. (d) Activation of chlorophyll molecules.

4



What does the previous process represent ?

(a) Osmosis. (b) Active transport.

(c) Imbibition. (d) Selective permeability.

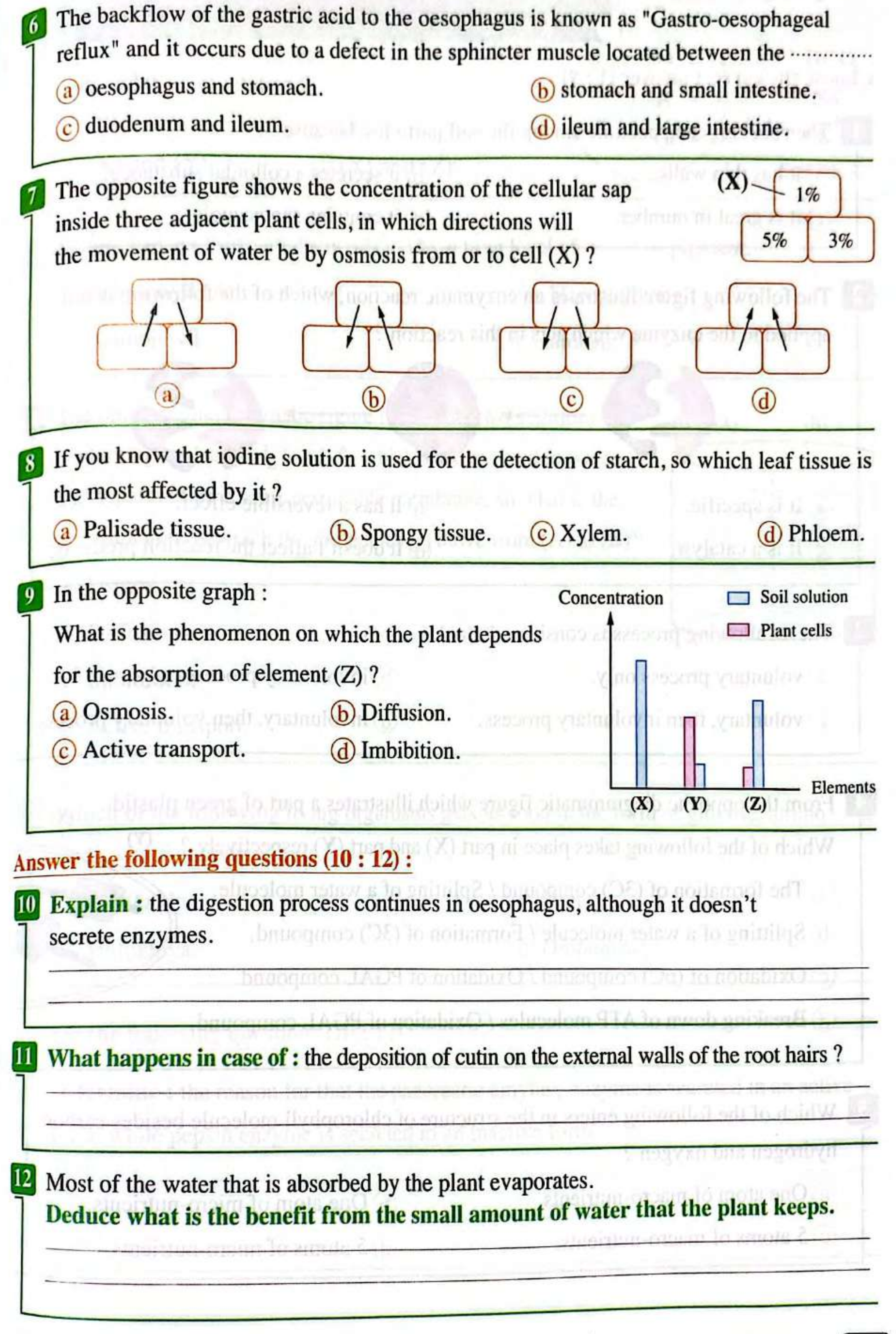
5 If the photosynthesis process is performed in the presence of chlorophyll $C_{55}H_{72}O_5N_4Mg$ containing carbon isotope ^{14}C and oxygen isotope ^{18}O. So, oxygen and glucose in the reaction products contain .... respectively.

(a) oxygen isotope and carbon isotope

(b) oxygen isotope and normal carbon

(c) normal oxygen and carbon isotope

(d) normal oxygen and normal carbon



6 The backflow of the gastric acid to the oesophagus is known as "Gastro-oesophageal reflux" and it occurs due to a defect in the sphincter muscle located between the ....

(a) oesophagus and stomach. (b) stomach and small intestine.
(c) duodenum and ileum. (d) ileum and large intestine.

7 The opposite figure shows the concentration of the cellular sap inside three adjacent plant cells, in which directions will the movement of water be by osmosis from or to cell (X) ?

8 If you know that iodine solution is used for the detection of starch, so which leaf tissue is the most affected by it ?

(a) Palisade tissue. (b) Spongy tissue. (c) Xylem. (d) Phloem.

9 In the opposite graph :

What is the phenomenon on which the plant depends for the absorption of element (Z) ?

(a) Osmosis. (b) Diffusion.
(c) Active transport. (d) Imbibition.

Answer the following questions (10 : 12) :

10 **Explain :** the digestion process continues in oesophagus, although it doesn't secrete enzymes.

....

....

11 **What happens in case of :** the deposition of cutin on the external walls of the root hairs ?

....

....

12 Most of the water that is absorbed by the plant evaporates.
Deduce what is the benefit from the small amount of water that the plant keeps.

....

....

Test 2 on the First Month

Choose the correct answer (1 : 9) :

1 The root hair can penetrate among the soil particles, because ....

ⓐ it has thin walls.
ⓑ it secretes a colloidal substance.
ⓒ it is great in number.
ⓓ it contains sap vacuole.

2 The following figure illustrates an enzymatic reaction, which of the following is <u>not</u> applied to the enzyme which acts in this reaction ?



ⓐ It is specific.
ⓑ It has a reversible effect.
ⓒ It is a catalyst.
ⓓ It doesn't affect the reaction products.

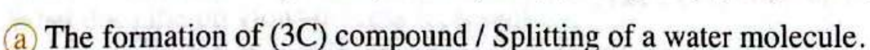
3 The swallowing process is considered a(an) ....

ⓐ voluntary process only.
ⓑ involuntary process only.
ⓒ voluntary, then involuntary process.
ⓓ involuntary, then voluntary process.

4 From the opposite diagrammatic figure which illustrates a part of green plastid :
Which of the following takes place in part (X) and part (Y) respectively ?

(X) (Y)

ⓐ The formation of (3C) compound / Splitting of a water molecule.
ⓑ Splitting of a water molecule / Formation of (3C) compound.
ⓒ Oxidation of (6C) compound / Oxidation of PGAL compound.
ⓓ Breaking down of ATP molecules / Oxidation of PGAL compound.



5 Which of the following enters in the structure of chlorophyll molecule besides carbon, hydrogen and oxygen ?

ⓐ One atom of macro-nutrients.
ⓑ One atom of micro-nutrients.
ⓒ 5 atoms of macro-nutrients.
ⓓ 5 atoms of micro-nutrients.

6 From the opposite figure, which of the following represent(s) the ion exchange between the root hair cells and the soil solution ?

Root hair cell: Na^+ (X) HCO_3^-; K^+ (Y) Na^+; Cl^- (Z) K^+ — Soil solution

ⓐ (X).
ⓑ (Y).
ⓒ (X) and (Y).
ⓓ (X) and (Z).

7 Mature banana fruits are distinguished by a high level of .... pigment.

ⓐ chlorophyll (A)
ⓑ chlorophyll (B)
ⓒ xanthophyll
ⓓ carotene

8 The opposite diagrammatic figure represents two solutions containing molecules □ and △ which are dissolved in water and separated by a semi-permeable membrane, so what is the phenomenon by which the molecules □ move from (A) to (B) ?

(A) (B)

ⓐ Osmosis.
ⓑ Diffusion.
ⓒ Imbibition.
ⓓ Active transport.

9 Which of the following living organisms gets its food in the form of glucose, amino acids, water and vitamins ?

ⓐ *Nitella* alga.
ⓑ Cactus.
ⓒ Mulukhiya.
ⓓ *Orobanche*.

Answer the following questions (10 : 12) :

10 **Determine :** the reason for that the pancreatic amylase enzyme is secreted in an active form, while pepsin enzyme is secreted in an inactive form.

11 **In the opposite figure :**

What happens in case of : the absence of part (Y) from structure (X) ?

(Y)

(X)

12 **Explain :** proteins that are produced by the plant cells to perform the required vital processes can't penetrate through their plasma membranes.

Test 1  on the Second Month

Choose the correct answer (1 : 9) :

1 Which of the following is from the components of blood that their lifespan reaches 120 days ?

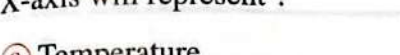
ⓐ The transport of enzymes.

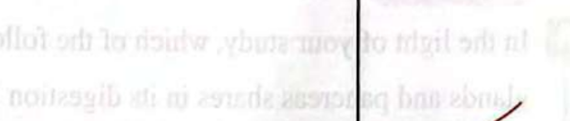
ⓑ The formation of bile juice.

ⓒ The adjustment of body temperature.

ⓓ Fighting the pathogens.

2 From the opposite graph, what do you expect that X-axis will represent ?





ⓐ Temperature.

ⓑ The salts concentration in the soil.

ⓒ The pH of the soil solution.

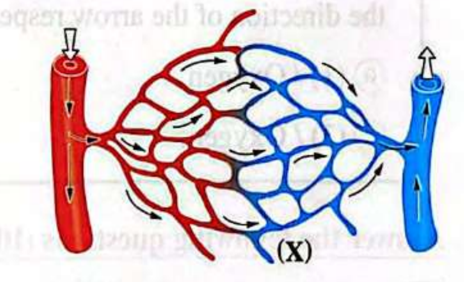
ⓓ Water content in the soil.

3 If glucose molecules and vitamin (A) are absorbed from a meal, what is the first place at which these absorbed substances are found together ?

ⓐ Superior vena cava. ⓑ Inferior vena cava.

ⓒ Right atrium. ⓓ Right ventricle.

4 In the opposite figure, what is the pressure value in blood vessel (X) ?



ⓐ 10 mm Hg.

ⓑ 70 mm Hg.

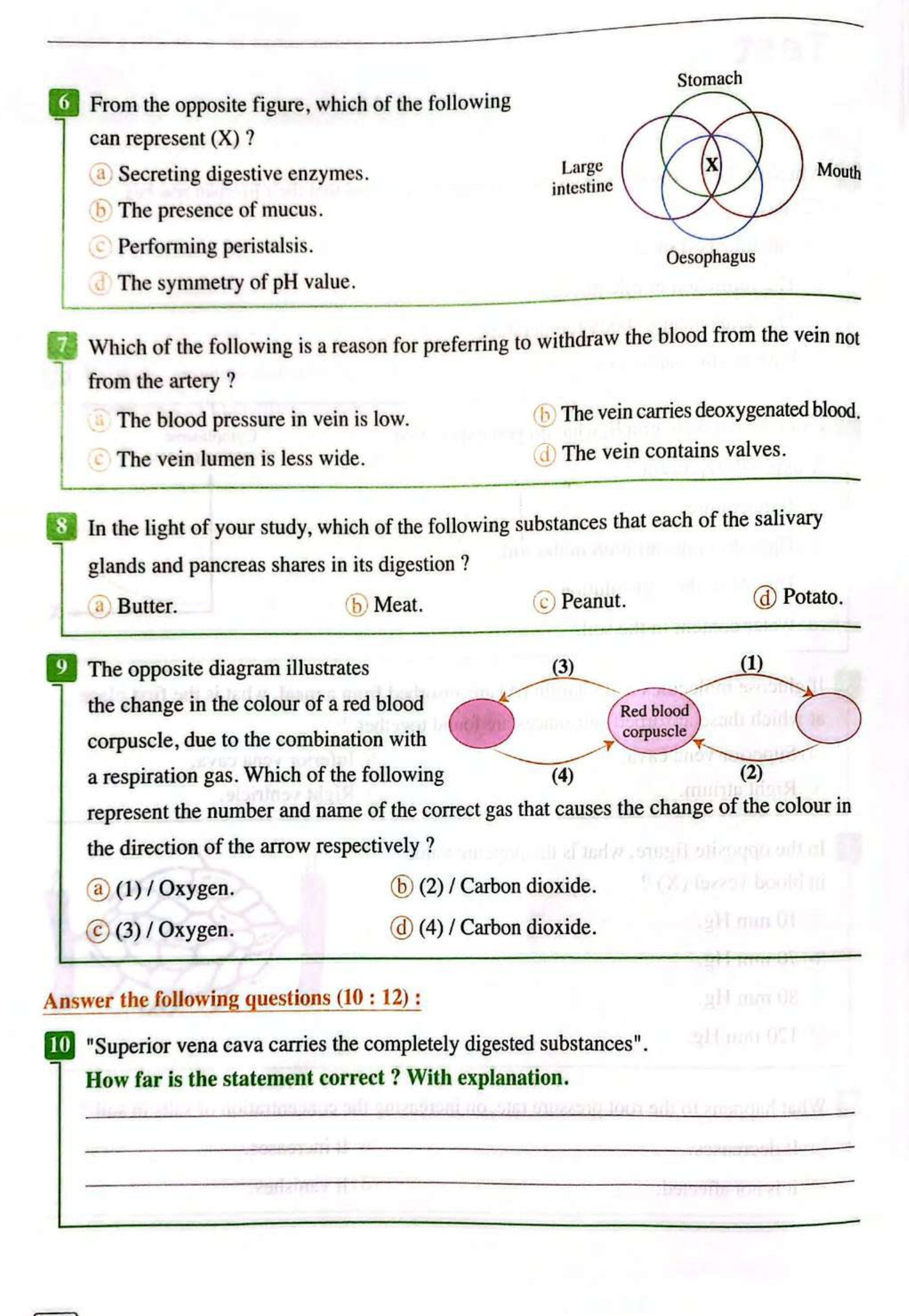
ⓒ 80 mm Hg.

ⓓ 120 mm Hg.

5 What happens to the root pressure rate, on increasing the concentration of salts in soil ?

ⓐ It decreases. ⓑ It increases.

ⓒ It is not affected. ⓓ It vanishes.



6 From the opposite figure, which of the following can represent (X) ?

ⓐ Secreting digestive enzymes.

ⓑ The presence of mucus.

ⓒ Performing peristalsis.

ⓓ The symmetry of pH value.

7 Which of the following is a reason for preferring to withdraw the blood from the vein not from the artery ?

ⓐ The blood pressure in vein is low.

ⓑ The vein carries deoxygenated blood.

ⓒ The vein lumen is less wide.

ⓓ The vein contains valves.

8 In the light of your study, which of the following substances that each of the salivary glands and pancreas shares in its digestion ?

ⓐ Butter.

ⓑ Meat.

ⓒ Peanut.

ⓓ Potato.

9 The opposite diagram illustrates the change in the colour of a red blood corpuscle, due to the combination with a respiration gas. Which of the following represent the number and name of the correct gas that causes the change of the colour in the direction of the arrow respectively ?

ⓐ (1) / Oxygen.

ⓑ (2) / Carbon dioxide.

ⓒ (3) / Oxygen.

ⓓ (4) / Carbon dioxide.

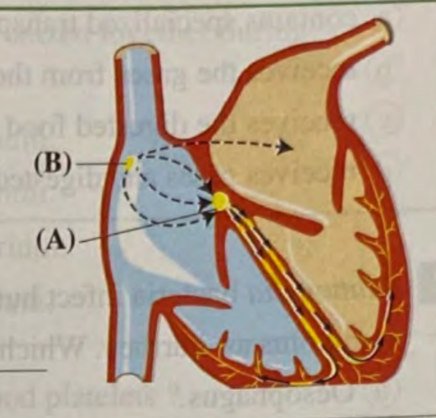
Answer the following questions (10 : 12) :

10 "Superior vena cava carries the completely digested substances".

How far is the statement correct ? With explanation.

11 **What happens in case of :** the exposure of the plant to an infection with a microbe and it reaches the xylem vessels (according to the transport process) ?

12 The opposite figure illustrates a longitudinal section in the human heart and the arrows represent the direct movement of the electric pulse which makes the muscle start to contract.



Illustrate the reason for the delay in the passage of the electric pulse that occurs at point (A).

Test 2 on the Second Month

Choose the correct answer (1 : 9) :

1 *Chlamydomonas* alga shares *Spirogyra* alga in that each of them ....

ⓐ contains specialized transport tissues.
ⓑ receives the gases from the surrounding medium by diffusion.
ⓒ receives the digested food substances by active transport.
ⓓ receives gases and digested food substances by diffusion and active transport.

2 *Salmonella* bacteria infect human when eating contaminated food or water causing some symptoms as diarrhea. Which part of the alimentary canal is the most affected ?

ⓐ Oesophagus. ⓑ Pharynx. ⓒ Stomach. ⓓ Intestine.

3 Which of the following characterizes the blood vessels that carry blood from arterioles to venules ?

ⓐ They don't pulsate. ⓑ They contain valves.
ⓒ Their walls are thick. ⓓ Their middle layer has elastic tissue.

4 Which of the following statements is correct about the transport in plant ?

ⓐ Sugars only transfer in phloem.
ⓑ Water only transfers in xylem vessels.
ⓒ Transport process in phloem needs the presence of ATP molecules.
ⓓ Transport process in xylem needs the presence of ATP molecules.

5 Which of the following is from the results of increasing peristalsis of the duodenum ?

ⓐ The bile juice production decreases.
ⓑ The pH value in small intestine decreases.
ⓒ The absorption rate of amino acids decreases.
ⓓ Secretion of sodium bicarbonate increases.

6 Which of the following is accompanied with systolic blood pressure ?

ⓐ Opening mitral valve. ⓑ Closure of tricuspid valve.
ⓒ Closure of aortic valve. ⓓ Closure of pulmonary valve.

7 Water in plant is translocated ....

ⓐ fast at noon and slow at night.
ⓑ slow at noon and fast at night.
ⓒ slow at noon and night.
ⓓ fast at noon and night.

8 Which of the following whose occurrence is **not** synchronized together during heartbeats ?

ⓐ Contraction of right ventricle / Relaxation of left atrium.
ⓑ Relaxation of left ventricle / Contraction of right atrium.
ⓒ Contraction of left ventricle / Contraction of right atrium.
ⓓ Relaxation of right ventricle / Contraction of left atrium.

9 In which do the red blood corpuscles share with the blood platelets ?

ⓐ Number / mm^3
ⓑ Volume.
ⓒ Absence of chromosomes.
ⓓ Number of regeneration times within a year.

Answer the following questions (10 : 12) :

10 **What happens in case of :** the absence of meristematic cells from the stem of a new dicot plant ?

11 **Give reason for :** the heartbeats of boxing champions reach about 180 beats/minute at the peak of competition.

12 From the opposite figure that illustrates a part of the digestive system in human :
Explain the difference in the nature of wastes in region (X) from region (Y).

10 General Exams

You can reach the exams of some schools and educational administrations by scanning **the opposite QR code**

All questions signed by ⊛ are answered in detail.

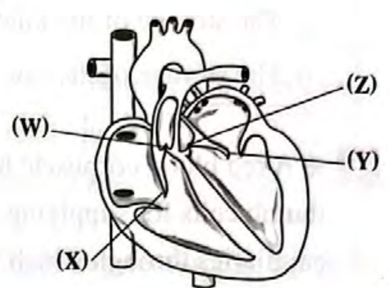
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General Exam 1



Choose the correct answer (1 : 20) :

1 The opposite figure shows a longitudinal section in the heart, which of the following valves prevent the backflow of the oxygenated blood ?



ⓐ (Y) & (W).
ⓑ (X) & (W).
ⓒ (Z) & (Y).
ⓓ (X) & (Y).

2 Which of the following conversions includes the oxidation process of co-enzymes ?

ⓐ Pyruvic acid from phosphoglyceraldehyde.
ⓑ Succinic acid from ketoglutaric acid.
ⓒ Malic acid from succinic acid.
ⓓ Lactic acid from pyruvic acid.

3 In an experiment, a student put four potato slices (the length of each slice was 5 cm) in salt solutions with different concentrations, then he recorded the results in the opposite table, depending on the recorded results, which of the following expresses the solution that has the highest concentration ?

Salt solution	The length of the slice after 30 minutes
(1)	4.5 cm
(2)	4.8 cm
(3)	5 cm
(4)	5.3 cm

ⓐ (1).
ⓑ (2).
ⓒ (3).
ⓓ (4).

4 Which of the following represents the correct arrangement for the stem tissues from inside to outside ?

ⓐ Epidermis / Cortex / Vascular bundle / Pericycle.
ⓑ Vascular bundle / Pericycle / Cortex / Epidermis.
ⓒ Vascular bundle / Epidermis / Cortex / Pericycle.
ⓓ Pericycle / Vascular bundle / Cortex / Epidermis.

5 Which of the following antagonizes with the function of chlorophyll in green plants ?

ⓐ The conversion of light energy into chemical energy.

ⓑ The absorption of the light energy required to photosynthesis.

ⓒ The storage of the kinetic light energy as a potential energy.

ⓓ The storage of the raw materials required to photosynthesis.

6 * A red blood corpuscle began its journey from an artery in the left arm directed to the thumb cells for supplying them with oxygen. What is the number of sites of the blood capillaries through which the red blood corpuscle passed during its journey till returning to the left ventricle ?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

7 * The opposite graph illustrates the activity of amylase enzyme, what can be concluded from this graph ?

The reaction products
60
40
20
0 1 2 3 4 5 6
Time (minute)

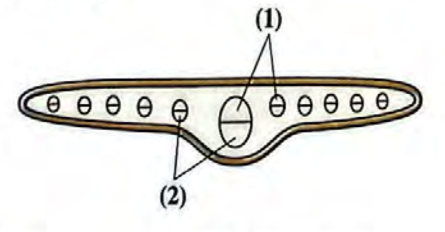
ⓐ The concentration of starch in the second minute is lower than that in the fourth minute.

ⓑ The concentration of glucose in the fourth minute is higher than that in the first minute.

ⓒ The concentration of maltose in the second minute is higher than that in the fourth minute.

ⓓ The concentration of maltose in the fourth minute is higher than the concentration of starch.

8 * In an experiment that illustrates the transport of water, the roots of a dicot plant were put in water coloured with a dye, after several hours, two sections were taken one from the stem and the other from the leaf of the plant. Which of the following parts would be coloured with the dye ?



(3)
(4)

ⓐ (1) and (3). ⓑ (2) and (4). ⓒ (2) and (3). ⓓ (1) and (4).

9 Which of the following is found in the human blood plasma in the normal cases ?

ⓐ Fibrin. ⓑ Thromboplastin. ⓒ Fibrinogen. ⓓ Thrombin.

10 Which of the following is(are) required for accomplishing the Krebs cycle in the presence of acetyl groups ?

ⓐ Glucose.
ⓑ NADH
ⓒ Respiratory enzymes.
ⓓ ATP molecules.

11 At pH = 8 and temperature 37°C, which of the following food substances **wouldn't** be digested, if it was externally treated with drops of the pancreatic juice ?

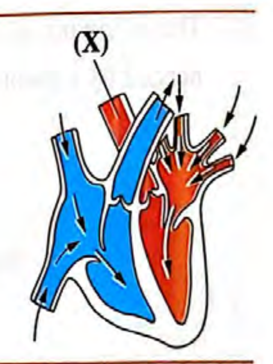
ⓐ A piece of meat.
ⓑ Peanut butter.
ⓒ A piece of bread.
ⓓ Rice.

12 * "The different food substances like cane sugar and amino acids transfer through the sieve tubes of phloem". Which of the following statements describes this process correctly ?

ⓐ Sugars transfer by active transport in some sieve tubes, while amino acids transfer by diffusion in the other sieve tubes.
ⓑ Sugars and amino acids transfer together by active transport in the same sieve tube of phloem.
ⓒ Sugars move upward and amino acids move downward.
ⓓ Sugars move downward and amino acids move upward.

13 Study the opposite figure, then determine :

What is the pressure value in blood vessel (X) ?

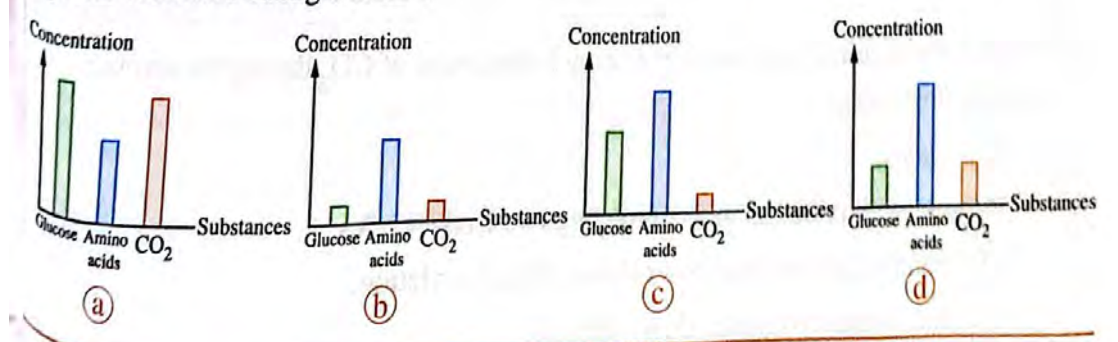


ⓐ 10 mm Hg.
ⓑ 70 mm Hg.
ⓒ 130 mm Hg.
ⓓ 160 mm Hg.

14 What are the food substances that are abundantly needed by a person doing weightlifting sport ?

ⓐ Juices and vegetables.
ⓑ Rice and juices.
ⓒ Meat and juices.
ⓓ Rice and vegetables.

15 Which of the following graphs describes the substances concentration in the hepatic portal vein after eating a meal ?



16 Some soil fungi cause wilting diseases for some crops, where they attack the xylem vessels and grow inside them, which of the following <u>isn't</u> affected by these fungi ?

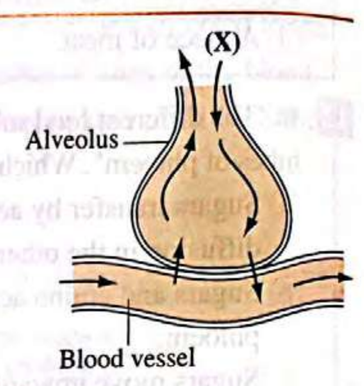
(a) Cohesion force among H_2O molecules.

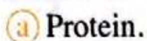
(b) The rate of performing photosynthesis process.

(c) The flow rate of solutes during transport process.

(d) The transpiration rate of plant during daytime.

17 By your study for the opposite figure, what is the substance that is formed from the combination of substance (X) with haemoglobin in the red blood corpuscle in the two lungs ?





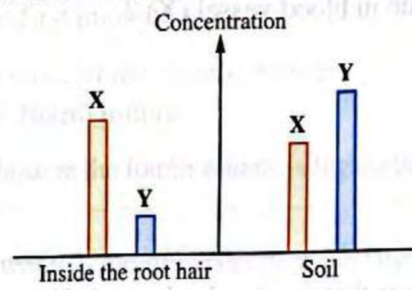
(a) Protein.

(b) Carbo-aminohaemoglobin.

(c) Iron.

(d) Oxyhaemoglobin.

18 The following graph shows the concentration of ion (X) and ion (Y) for the elements needed by a plant in the soil and inside the root hair of this plant :



What are the physical phenomena that lead to the transferring of (X) and (Y) respectively ?

(a) Active transport / Diffusion.

(b) Selective permeability / Active transport.

(c) Diffusion / Selective permeability.

(d) Selective permeability / Diffusion.

19 What is the required condition for exiting 6 molecules of CO_2 during the aerobic cellular respiration ?

(a) Glycolysis.

(b) Pyruvic acid oxidation and completing two Krebs cycles.

(c) The occurrence of complete oxidative phosphorylation.

(d) The consumption of more O_2 by the cell.



20 What happens if you put a plant cell in a sucrose solution whose concentration is more than the cell osmotic pressure ?

ⓐ It will swell. ⓑ It will shrink.

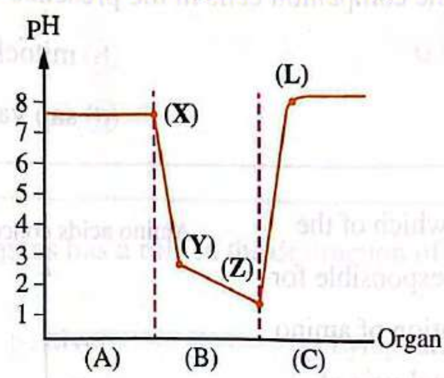
ⓒ It will not be affected. ⓓ It will burst.



Answer the following questions (21 : 23) :

21 **What is the relation between :** the red blood cells and facilitating the digestion of fats ?

22 **The following graph illustrates three organs in the digestive canal (A), (B) and (C) :**



Illustrate the substance which is responsible for the change in pH :

(a) From point (X) to point (Y).

(b) From point (Z) to point (L).

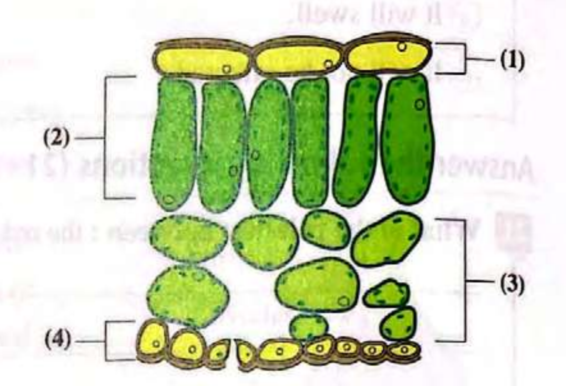
23 **Suggest one reason for :** stopping the reactions of the electron transport chain.

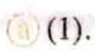
General Exam 2

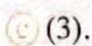


Choose the correct answer (1 : 20) :

1 The opposite figure illustrates a part of the transverse section in a leaf of a plant, which of the following tissues is the most efficient to perform the photosynthesis process ?




(a) (1). (b) (2).

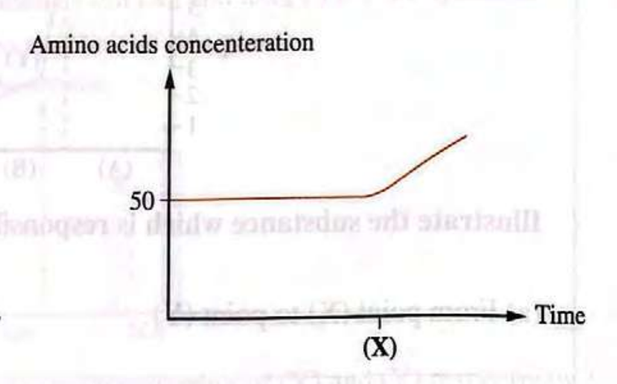

(c) (3). (d) (4).

2 The sieve tubes share the companion cells in the presence of ....

(a) cytoplasm. (b) mitochondria.

(c) nucleus. (d) sap vacuole.

3 In the opposite graph, which of the following enzymes is responsible for changing the concentration of amino acids in the hepatic portal vein at point (X) ?



(a) Lipase. (b) Amylase.

(c) Peptidase. (d) Pepsin.

4 * Which of the following percentages are equal ?

(a) The percentage of O_2 in the inhaled air with its percentage in the alveolar air.

(b) The percentage of CO_2 in the exhaled air with its percentage in the alveolar air.

(c) The percentage of N_2 in the inhaled air with its percentage in the exhaled air.

(d) The percentage of H_2O in the inhaled air with its percentage in the exhaled air.

5 How far are these statements "the green plant is autotrophic", "it absorbs water and glucose from the soil" correct ?

ⓐ The two statements are correct and related.
ⓑ The two statements are correct and not related.
ⓒ The first statement is correct and the second statement is wrong.
ⓓ The first statement is wrong and the second statement is correct.

6 The opposite diagrammatic figure represents the heart and the main blood vessels, which of the following blood vessels has the highest blood pressure ?

ⓐ R
ⓑ S
ⓒ P
ⓓ Q

7 Which of the following organs has a role in the destruction of blood cells and causes the blood liquidity ?

ⓐ Spleen. ⓑ Liver. ⓒ Lymphatic node. ⓓ Bone marrow.

8 Which of the following elements is(are) **not** present in the food of aphid insect, when it is examined ?

ⓐ Amino acids. ⓑ Fatty acids. ⓒ Sucrose. ⓓ Water.

9 ✱ The opposite figure illustrates two types of the body fluids circulating inside the vessels, if you know that (Y) contains enucleated cells, what do you expect about the components of fluid (Z) ?

ⓐ Water and soluble proteins.
ⓑ White blood corpuscles and insoluble proteins.
ⓒ Blood platelets and white blood corpuscles.
ⓓ Red blood corpuscles and blood platelets.

10 The blood that is transferred in each of pulmonary artery and inferior vena cava ....

ⓐ has the same pressure.
ⓑ passes in a cavity with different width.
ⓒ has the same direction.
ⓓ has a higher level of oxygen.

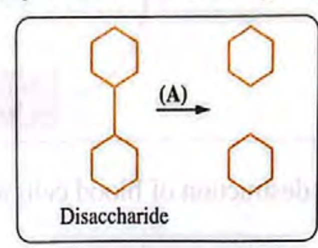
11 Which of the following vital processes **doesn't** need ATP ?

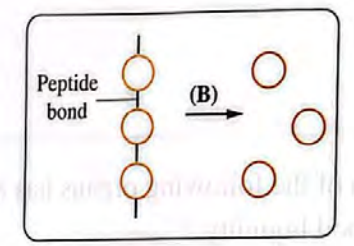
ⓐ Aerobic respiration.
ⓑ Glycolysis.
ⓒ Anaerobic respiration.
ⓓ H_2O splitting in the photosynthesis process.

12 "After eating too much salty sunflower seeds, we feel roughness in the internal side of lips". What is the reason for that ?

ⓐ The entry of salt into the lips' cells leads to their swelling.
ⓑ The exit of salt from the lips' cells leads to their shrinkage.
ⓒ The entry of water into the lips' cells leads to their swelling.
ⓓ The exit of water from the lips' cells leads to their shrinkage.

13 By your study to the two following diagrams :





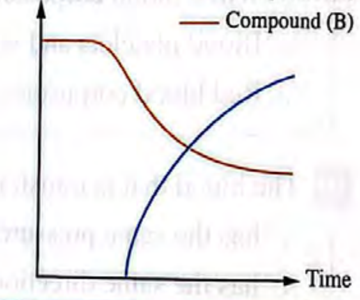
What is the suitable value of pH for the activation of enzymes (A) and (B) together ?

ⓐ 1.5
ⓑ 2.5
ⓒ 8
ⓓ 9

14 Which blood vessel contains the highest percentage of fats after completing the digestion and absorption processes ?

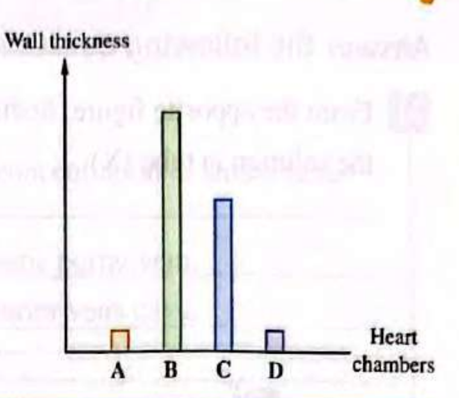
ⓐ Superior vena cava.
ⓑ Inferior vena cava.
ⓒ Hepatic portal vein.
ⓓ Hepatic vein.

15 The opposite graph represents the concentration of two types of compounds in the thigh muscles, during performing vigorous exercises, which of the following expresses (A) and (B) compounds respectively ?



ⓐ ADP / Glucose.
ⓑ Lactic acid / Glucose.
ⓒ Glycogen / ATP
ⓓ Glycogen / Lactic acid.

16 Study the opposite graph which shows the difference in the thickness of the heart chambers in human, what is the chamber that is represented by column (B) ?



ⓐ Right atrium. ⓑ Right ventricle.
ⓒ Left ventricle. ⓓ Left atrium.

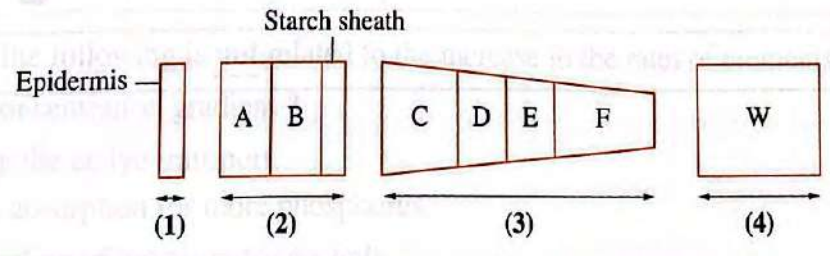
17 Which of the following choices expresses the distinguished characteristics of the structures that are found in the phloem of a cotton plant leaf ?

	Concentration of solutes in the cell	Lignification of cell walls
ⓐ	Low	Low
ⓑ	Low	High
ⓒ	High	Low
ⓓ	High	High

18 Which of the following compounds whose deficiency affects both the rate of respiration and photosynthesis processes in *Elodea* plant ?

ⓐ ATP ⓑ FAD ⓒ NAD^+ ⓓ NADP

19 The following diagram shows 4 parts in the stem of a dicot plant arranged from outside to inside, study it, then determine :



What is the function in which the cells of tissues (D) and (F) share ?

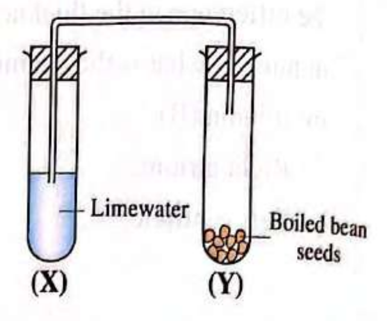
ⓐ Aeration. ⓑ Elasticity. ⓒ Sap storage. ⓓ Sap transfer.

20 In which of the following plants do you expect that the thickness of the precipitated cuticle layer on its epidermal cells increases ?

ⓐ Bean. ⓑ Corn. ⓒ *Elodea*. ⓓ Cactus.

Answer the following questions (21 : 23) :

21 From the opposite figure, **deduce** what happens to the solution in tube (X).



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____

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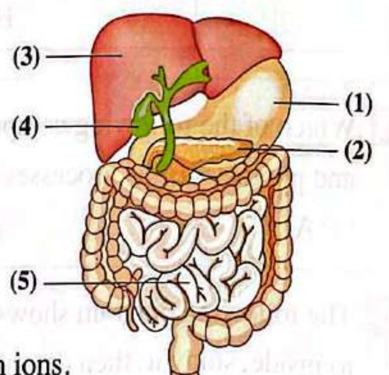
22 **Explain :** leaves represent the production lines, while phloem tissue represents the distribution lines in plant.

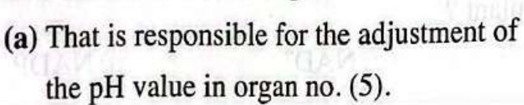
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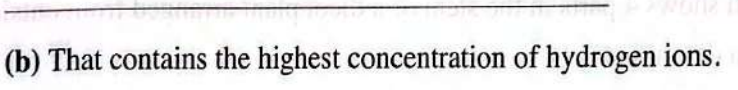
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23 **The opposite figure illustrates a part of the human digestive system, write the number and the name of the organ :**




(a) That is responsible for the adjustment of the pH value in organ no. (5).


(b) That contains the highest concentration of hydrogen ions.

____

General Exam 3



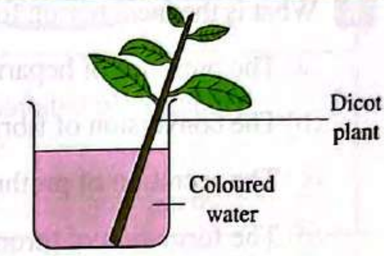
Choose the correct answer (1 : 20) :

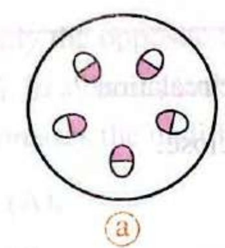
1 In which of the following blood vessels is the highest concentration of amino acids found after eating a meal rich in proteins ?

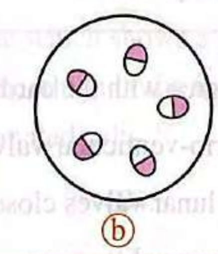
ⓐ Hepatic vein. ⓑ Hepatic portal vein.

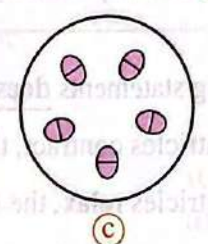
ⓒ Inferior vena cava. ⓓ Superior vena cava.

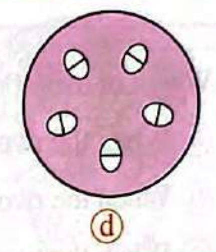
2 * Which of the following figures represents a transverse section in the stem of the plant that is illustrated in the opposite figure ?




ⓐ


ⓑ


ⓒ


ⓓ

3 What happens when the number of red blood corpuscles in an adult person reaches 3 million cells / mm^3 of blood ?

ⓐ Its red colour intensity remains constant.

ⓑ The haemoglobin level increases in blood.

ⓒ The iron level increases in blood.

ⓓ The iron and haemoglobin levels decrease in blood.

4 * Which of the following is **not** related to the increase in the rates of elements diffusion against the concentration gradient ?

ⓐ Increasing the active transport.

ⓑ The plant absorption for more phosphorus.

ⓒ The absorption of macro-nutrients only.

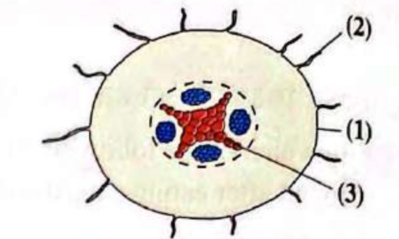
ⓓ The increase in the respiration rates.

5 * Which of the following is synchronized with the relaxation of the walls of the right atrium ?

ⓐ Opening of mitral valve. ⓑ Closure of pulmonary valve.

ⓒ Opening of tricuspid valve. ⓓ Opening of aortic valve.

6 The opposite figure illustrates a transverse section in the plant root, which of the following parts play(s) the main role in the absorption of water and salts' ions ?



ⓐ (1).
ⓑ (2).
ⓒ (1) and (2).
ⓓ (3).

7 What is the main reason for starting the blood clot formation when a wound takes place ?

ⓐ The presence of heparin in blood.
ⓑ The conversion of fibrinogen into fibrin.
ⓒ The secretion of prothrombin by liver.
ⓓ The formation of thromboplastin by blood platelets.

8 Which of the following statements **doesn't** agree with the cardiac circulation ?

ⓐ When the two ventricles contract, the atrio-venticular valves close.
ⓑ When the two ventricles relax, the semi-lunar valves close.
ⓒ When the two atria contract, the semi-lunar valves open.
ⓓ When the two atria contract, the atrio-venticular valves open.

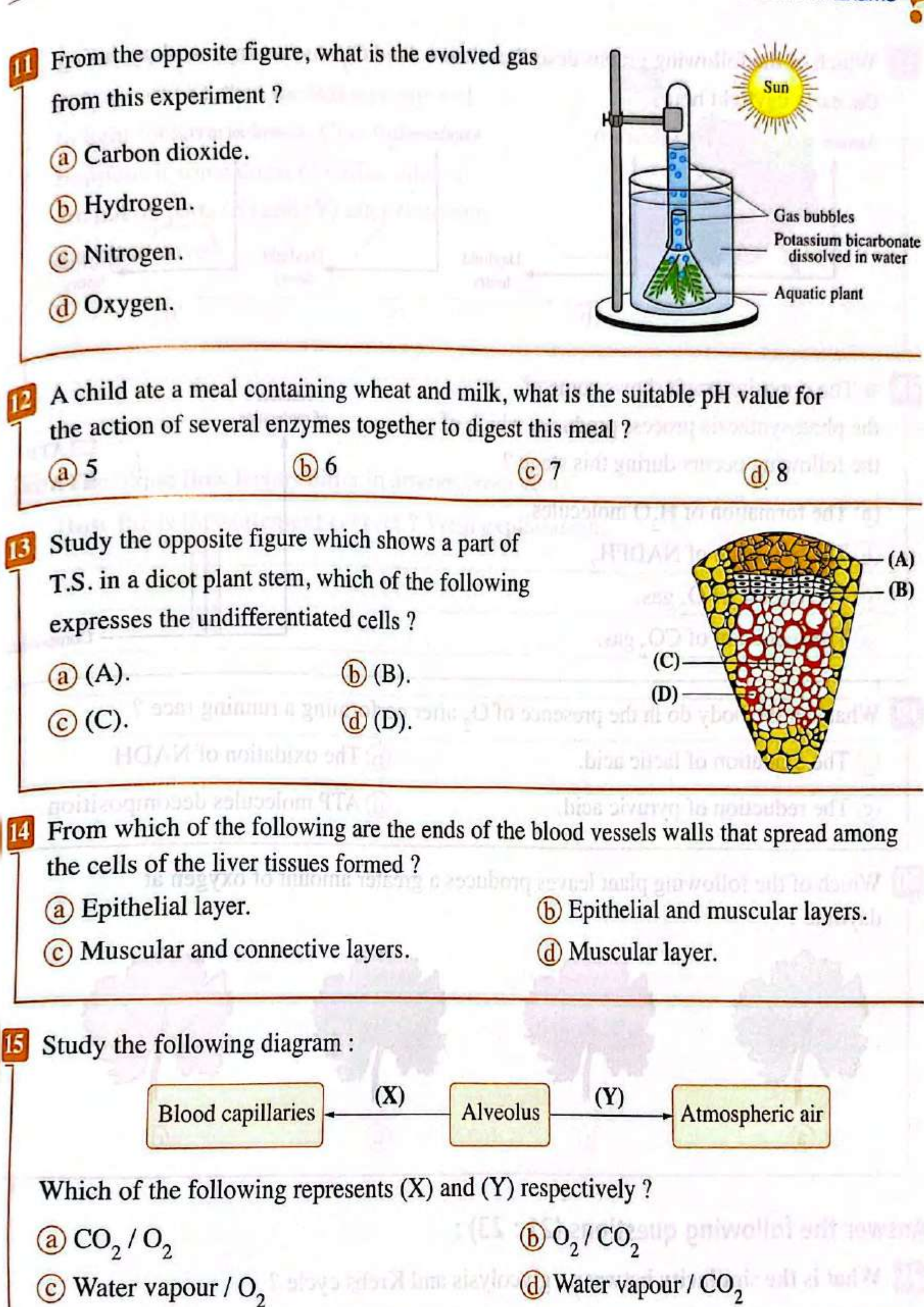
9 * What is the difference between the fermentation in yeast fungus and the fermentation in a fatigued muscle fiber ?

ⓐ The difference in the released energy amount from one molecule of glucose.
ⓑ Releasing less amount of CO_2
ⓒ The breaking down of a lower number of chemical bonds.
ⓓ Fats and proteins aren't used as a source of energy.

10 Which of the following statements is applied to the enzymes which are present in the raw fruits and vegetables ?

ⓐ These enzymes don't work inside the plant.
ⓑ These enzymes change their substrates inside the human body.
ⓒ The enzymes that are present in them become damaged by heating and cooking.
ⓓ These enzymes increase the activation energy.

11 From the opposite figure, what is the evolved gas from this experiment ?



ⓐ Carbon dioxide.

ⓑ Hydrogen.

ⓒ Nitrogen.

ⓓ Oxygen.

12 A child ate a meal containing wheat and milk, what is the suitable pH value for the action of several enzymes together to digest this meal ?

ⓐ 5 ⓑ 6 ⓒ 7 ⓓ 8

13 Study the opposite figure which shows a part of T.S. in a dicot plant stem, which of the following expresses the undifferentiated cells ?

ⓐ (A). ⓑ (B).

ⓒ (C). ⓓ (D).

14 From which of the following are the ends of the blood vessels walls that spread among the cells of the liver tissues formed ?

ⓐ Epithelial layer. ⓑ Epithelial and muscular layers.

ⓒ Muscular and connective layers. ⓓ Muscular layer.

15 Study the following diagram :

Blood capillaries ← (X) — Alveolus — (Y) → Atmospheric air

Which of the following represents (X) and (Y) respectively ?

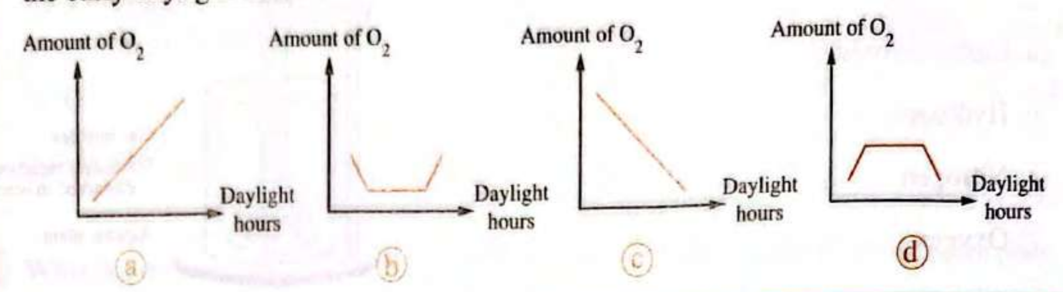
ⓐ CO_2 / O_2 ⓑ O_2 / CO_2

ⓒ Water vapour / O_2 ⓓ Water vapour / CO_2

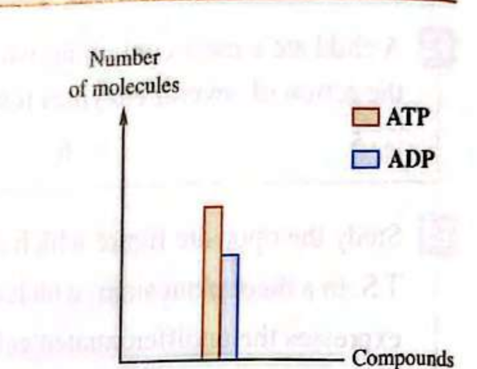
16 Which body organ can form and destroy two types of blood components ?

ⓐ Heart. ⓑ Liver. ⓒ Pancreas. ⓓ Spleen.

17 Which of the following graphs describes the evolved O_2 amount from a plant during the early daylight hours ?



18 * The opposite graph shows some of the photosynthesis process products, which of the following occurs during this stage ?



a) The formation of H_2O molecules.

b) The oxidation of $NADPH_2$

c) The release of O_2 gas.

d) The reduction of CO_2 gas.

19 What can the body do in the presence of O_2 after performing a running race ?

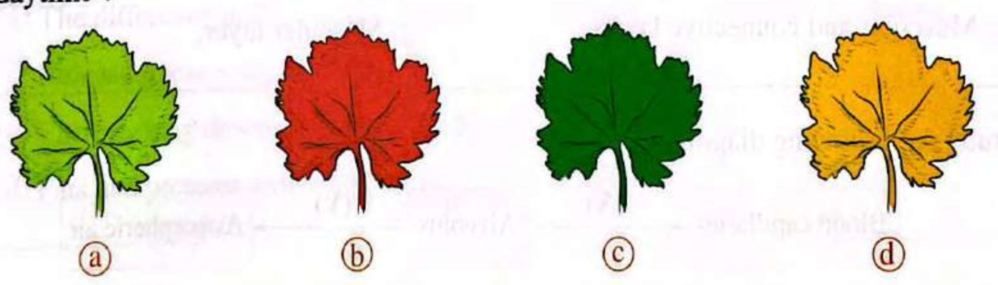
a) The oxidation of lactic acid.

b) The oxidation of NADH

c) The reduction of pyruvic acid.

d) ATP molecules decomposition.

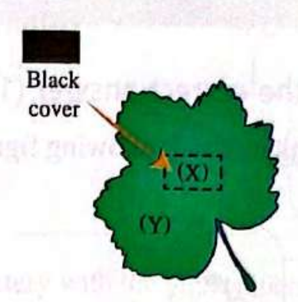
20 Which of the following plant leaves produces a greater amount of oxygen at daytime ?



Answer the following questions (21 : 23) :

21 **What is the similarity between :** glycolysis and Krebs cycle ?

22 In the opposite figure, a black cover was put on part (X), then the leaf was exposed to light for several hours. **Conclude what happens if** some drops of iodine solution are put on parts (X) and (Y) after removing the black cover.



23 "The blood flow factors differ in arteries from veins".

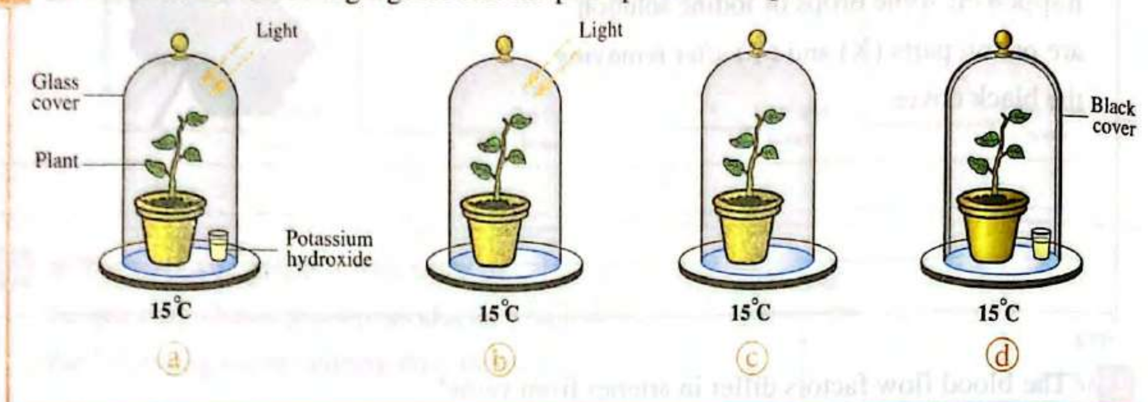
How far is the statement correct ? With explanation.

General Exam 4



Choose the correct answer (1 : 20) :

1 In which of the following figures can the plant perform the photosynthesis process ?



2 Which of the following **doesn't** agree with glycolysis and the reactions which occur in the grana of the chloroplast ?

ⓐ Both of them need energy.
ⓑ ATP molecules are released from both of them.
ⓒ Their occurrence is associated with the presence of co-enzymes.
ⓓ 3-carbon compound is formed in each one of them.

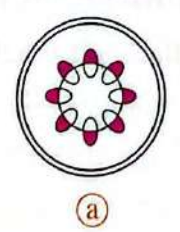
3 After performing a muscular effort, which of the following blood vessels carries the lowest concentration of CO_2 ?

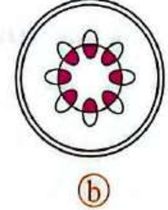
ⓐ Hepatic vein. ⓑ Pulmonary artery. ⓒ Pulmonary vein. ⓓ Vena cava.

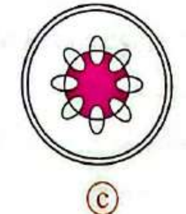
4 * What is the number of CO_2 molecules which is resulted from Krebs cycle, starting with a molecule of maltose ?

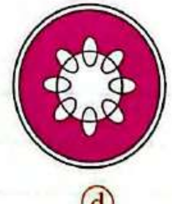
ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

5 A plant was put in water containing red dye for 24 hours, then it was removed and several sections were taken from the plant stem, which of the following figures illustrates that ?


ⓐ

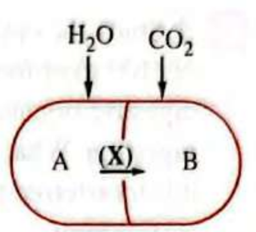

ⓑ


ⓒ


ⓓ



6 The opposite diagrammatic figure shows what happens inside the green plastid, which of the following represents (X) ?



ⓐ ATP and PGAL ⓑ ADP and CO_2
ⓒ H_2O and NADP ⓓ $NADPH_2$ and ATP

7 Which of the following is(are) found in the pulmonary artery with the highest percentage ?

ⓐ Oxyhaemoglobin. ⓑ Carbo-aminohaemoglobin.
ⓒ Haemoglobin. ⓓ Haemoglobin and oxyhaemoglobin.

8 * In which of the following stages is the least amount of ATP molecules released directly ?

ⓐ Glycolysis. ⓑ Oxidation of pyruvic acid into acetyl group.
ⓒ One Krebs cycle. ⓓ Electron transport chain.

9 The epidermis in plant stem has several functions which are storage, support and aeration. Which of the following tissues perform these functions respectively ?

ⓐ Parenchyma / Collenchyma / Starch sheath.
ⓑ Collenchyma / Parenchyma / Starch sheath.
ⓒ Parenchyma / Starch sheath / Collenchyma.
ⓓ Starch sheath / Collenchyma / Parenchyma.

10 What is the organ which secretes digestive juices for all types of food ?

ⓐ Stomach. ⓑ Liver. ⓒ Pancreas. ⓓ Duodenum.

11 What is(are) the substance(s) that form(s) the greatest portion of lymph ?

ⓐ Water. ⓑ Fats.
ⓒ Proteins. ⓓ Monosaccharides.

12 Which of the following is resulted from the presence of a hole in the septum between the two ventricles ?

ⓐ The stopping of Purkinje bundle action.
ⓑ The mixing of some oxygenated blood with the deoxygenated blood.
ⓒ The stopping of sino-atrial node action.
ⓓ The inability of the two ventricles to pump the blood.

13 * Study the opposite graph which shows the route of (100 g) of food substance (X) through different digestive organs after more than one hour of its ingestion. What is the form of substance (X) when it is transferred through the villi of small intestine ?

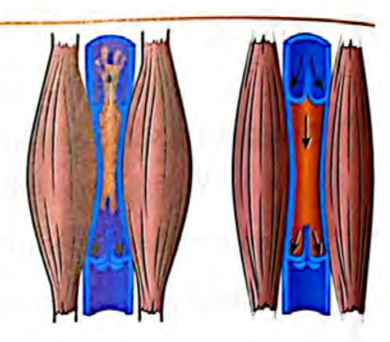
Amount of substance (X)
100 g
50 g
Mouth Stomach Small intestine
Digestive system organs

ⓐ Glycerol.
ⓑ Monosaccharides.
ⓒ Fatty acids.
ⓓ Amino acids.

14 What is the substance whose formation is affected by the decrease in vitamin (K) in blood ?

ⓐ Heparin. ⓑ Fibrin.
ⓒ Prothrombin. ⓓ Thromboplastin.

15 From studying the two opposite figures, what is the role of the muscles that surround the blood vessel ?



ⓐ Opening the valve when the muscles contract.
ⓑ Opening the valve when the muscles relax.
ⓒ The closure of the valve when a muscle contracts and the opposite muscle relaxes.
ⓓ Opening the valve when a muscle contracts and the opposite muscle relaxes.

16 Study the following pathways, then answer :

- Alveolus ⟶ O_2 ⟶ Blood capillaries.
- Small intestine ⟶ Amino acids ⟶ Blood capillaries.
- Atmospheric air ⟶ CO_2 ⟶ Plant cells.

What is the common mechanism in transferring the substances in the previous pathways ?

ⓐ Active transport. ⓑ Osmosis. ⓒ Diffusion. ⓓ Imbibition.

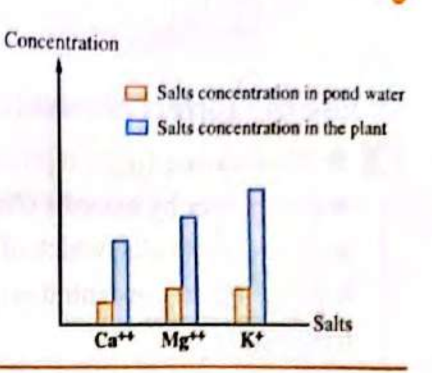
17 Which of the following is correct about what happens in the heart valves and is represented by the diastolic number during the blood pressure measurement ?

ⓐ The closure of aortic valve and opening the pulmonary valve.
ⓑ Opening the tricuspid valve and the closure of aortic valve.
ⓒ The closure of mitral and tricuspid valves.
ⓓ Opening the aortic and pulmonary valves.

18 Which of the following substances <u>isn't</u> formed inside the liver ?

ⓐ Bile juice. ⓑ Heparin.
ⓒ Glycogen. ⓓ Lipase enzyme.

19 From the opposite graph, by which of the following mechanisms the plant absorbs salts ?



(a) Diffusion.

(b) Permeability.

(c) Active transport and permeability.

(d) Cation or anion exchange.


20 Study the following table, then answer :

Substance	Concentration in villus	Concentration in transport vessels
Na^+	155 mg / 100 mL	15 mg / 100 mL
Glycine	0.1%	0.02%
H_2O	75%	70%
Cl^-	1.01 mg / 100 mL	1.5 mg / 100 mL
Fat droplets	0.35%	0.33%

Which of the following substances will be transferred to the transport vessels by the same phenomenon ?

(a) Na^+ and Cl^- ions.

(b) H_2O and Cl^- ions.

(c) Cl^- ions and glycine.

(d) Glycine and fat droplets.

Answer the following questions (21 : 23) :

21 **Write what the statement indicates :** "Non-living plant structures, where the shape of their inner surface changes from a plant to another".

____

22 From the opposite diagram, if you know that (A) and (B) are intermediate compounds which are formed through one of the cellular respiration stages inside the mitochondria and each one of them consists of the same number of carbon atoms, **what** is the name of product no. (1) ?

A —Oxidation→ B
ATP (1)

____

23 If you know that the saline solution which is given through a venous injection, its concentration is 0.9%, **deduce** what happens to the red blood corpuscles when the concentration of the saline solution is 1% or 0.5 %. **Explain your answer.**

____

____

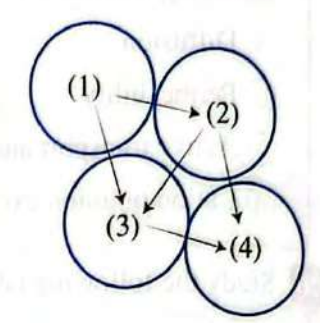
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General Exam 5

Choose the correct answer (1 : 20) :

1 * The opposite figure represents the movement of water transfer by osmosis phenomenon among four adjacent plant cells, which of the following cells has the highest concentration of salts before water transferring ?



ⓐ (1).   ⓑ (2).
ⓒ (3).   ⓓ (4).

2 If a blood sample of a person contains 45% plasma, what is applied to this person ?

ⓐ This person has a deficiency in the salts percentage.
ⓑ This person drinks much water.
ⓒ This person suffers from anemia.
ⓓ This person has an increase in the number of RBCs.

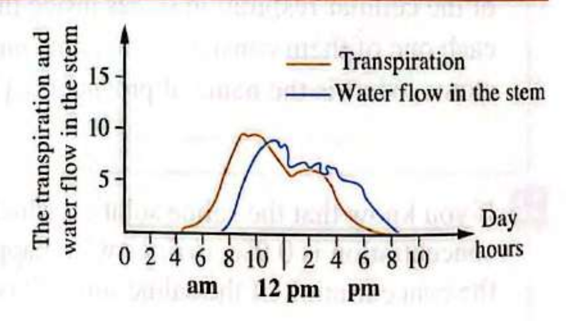
3 Which of the following **doesn't** agree with the occurrence of anaerobic respiration in the muscle ?

ⓐ The increase of lactic acid in the muscle.
ⓑ The depletion of oxygen in blood that reaches the muscle.
ⓒ The production of a large amount of NADH molecules.
ⓓ The muscle fatigue.

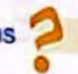
4 In which of the following cases the blood pressure value in human is the least ?

ⓐ The contraction of left ventricle.   ⓑ The relaxation of right atrium.
ⓒ The closure of bicuspid valve.   ⓓ The closure of semi-lunar valves.

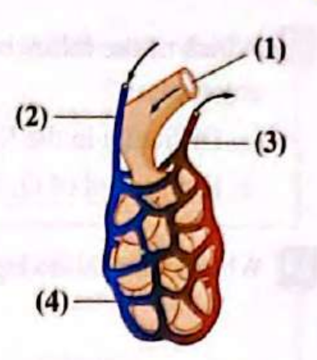
5 * What do you conclude from your study to the opposite graph ?



ⓐ The transpiration rate is constant all the day.
ⓑ There is no relation between the water flow in the stem and the transpiration rate.
ⓒ The highest flow of water in the stem is delayed than the highest transpiration rate.
ⓓ The transpiration rate can't reach zero.



6 From the opposite figure, which of the following structures contains the highest concentration of O_2 gas comparing to its concentration in the atmospheric air ?



(a) (1).
(b) (2).
(c) (3).
(d) (4).

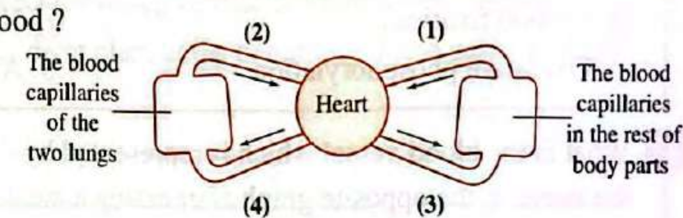
7 Which of the following statements is applied to the digestive juices that are secreted by liver and pancreas ?

(a) They digest the same food substances.
(b) They work at the same pH value.
(c) Their enzymes need activators to work.
(d) The same products of digestion are produced by their action.

8 Which of the following is not found in the blood plasma ?

(a) Insulin hormone. (b) Urea. (c) Albumin. (d) Oxygen.

9 * In the opposite figure, which of the blood vessels carry oxygenated blood ?



(a) (1) & (2).
(b) (1) & (3).
(c) (2) & (3).
(d) (2) & (4).

10 What happens during the passage of the food bolus in the oesophagus ?

(a) The carbohydrates digestion continues. (b) The fats digestion starts.
(c) The proteins digestion starts. (d) The digestion process stops.

11 What should be present for the occurrence of the anaerobic cellular respiration ?

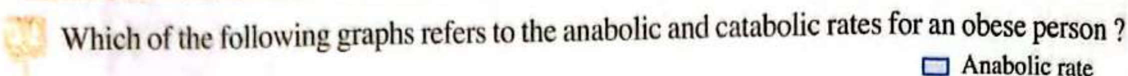
(a) O_2 (b) CO_2 (c) Specific enzymes. (d) FAD

12 When will the process of water rising by the force of root pressure stop ?

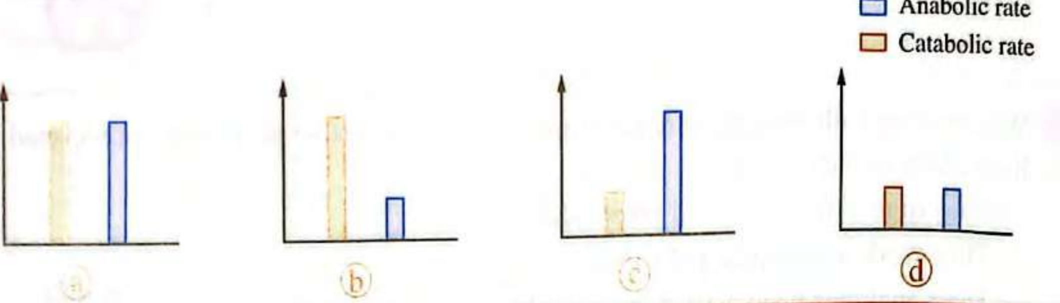
(a) When the water comes out from the stem by exudation.
(b) When the water transfers to the root cells by the imbibition phenomenon.
(c) When it increases more than 2 atmospheric pressure (atm).
(d) When it becomes equal to the pressure of water column in xylem vessels.

13 Which of the following may occur if suberin precipitated on the double membranes of chloroplast ?

ⓐ Difficulty in the light passage.
ⓑ Chlorophyll won't be formed.
ⓒ High speed of O_2 formation.
ⓓ Water passes easily.



14 Which of the following graphs refers to the anabolic and catabolic rates for an obese person ?



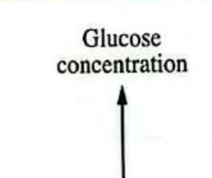
15 The living plant cells keep the internal concentration of ions which differs from the external concentration, what is the reason for continuing the difference in concentration ?

ⓐ Cell walls.
ⓑ Cell vacuoles.
ⓒ Plastids.
ⓓ Cell membranes.

16 Which of the following **doesn't** happen during dark reactions ?

ⓐ Carbon fixation.
ⓑ $NADPH_2$ oxidation.
ⓒ Oxidative phosphorylation.
ⓓ ATP consumption.

17 What is the blood vessel which is represented by the curve in the opposite graph after eating a meal rich in carbohydrates ?



ⓐ Hepatic portal vein.
ⓑ Pulmonary artery.
ⓒ Hepatic vein.
ⓓ Hepatic artery.

18 When we put the RBCs in a salt solution of unknown concentration for a period of time, the cells shrink, what do you conclude from this ?

ⓐ The concentration of salts in the solution is less than their concentration in the blood cells.
ⓑ The concentration of salts in the solution is more than their concentration in the blood cells.
ⓒ The concentration of salts in the solution is equal to their concentration in the blood cells.
ⓓ There is no relation between the salts concentration and the cells shrinkage.

19 How many heart valves through which a red blood corpuscle passes when it transfers from the right arm to the left arm are found ?

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

20 Which of the following enter(s) in the structure of ATP molecule that is made by the plant in addition to carbon, hydrogen and oxygen ?

ⓐ A macro-nutrient and a micro-nutrient.
ⓑ Two micro-nutrients.
ⓒ A macro-nutrient.
ⓓ Two macro-nutrients.

Answer the following questions (21 : 23) :

21 **Explain :** the salivary amylase enzyme is secreted in an active form, while trypsin enzyme is secreted in an inactive form.

22 **Calculate :** the number of ATP molecules which is resulted from the oxidation of 10 glucose molecules inside a seed of a dicot plant at the beginning of the germination process.

23 "The speed of the food substances transport in the plant depends on some external factors". **How far is the statement correct ? With explanation.**

General Exam 6



Choose the correct answer (1 : 20) :

1 Which of the following elements its absence **doesn't** affect the photosynthesis process ?

ⓐ Iron. ⓑ Phosphorus. ⓒ Calcium. ⓓ Magnesium.

2 What is the similarity between the lymphatic system and the circulatory system ?

ⓐ The presence of nodes that work on getting rid of pathogens.

ⓑ The presence of a network of arteries.

ⓒ The presence of a network of blood capillaries.

ⓓ Performing an immune function.

3 Which of the following tissues has the ability to divide mitotically in the plant ?

ⓐ Xylem. ⓑ Phloem. ⓒ Palisade tissue. ⓓ Cambium.

4 * In the opposite diagram, what do the two processes (1) and (2) represent ?

A (12C) —(1)→ B —(2)→ D + E + 38 ATP

ⓐ (1) is hydrolysis and (2) is catabolism.

ⓑ (1) is anabolism and (2) is hydrolysis.

ⓒ (1) is anabolism and (2) is catabolism.

ⓓ (1) is catabolism and (2) is anabolism.

5 What is the importance of water in photosynthesis process ?

ⓐ A solvent for carbon dioxide gas.

ⓑ A source for the evolved oxygen.

ⓒ A source for hydrogen that is required for the reduction process.

ⓓ A receiver for light energy.

6 When CO_2 is consumed in photosynthesis process, which of the following illustrates the path of CO_2 diffusion in the leaf after entering through the stomata ?

ⓐ Cell wall → Plasma membrane → Intercellular spaces → Cytoplasm → Plastid's membrane.

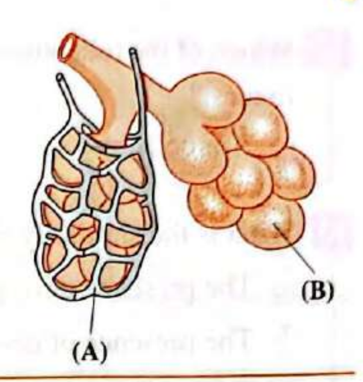
ⓑ Intercellular spaces → Cell wall → Plasma membrane → Cytoplasm → Plastid's membrane.

ⓒ Intercellular spaces → Plasma membrane → Cell wall → Plastid's membrane → Cytoplasm.

ⓓ Intercellular spaces → Cytoplasm → Plasma membrane → Cell wall → Plastid's membrane.



7 In the opposite figure, structure (B) is surrounded by a network of structures (A) to transfer .... easily.



ⓐ O_2 from (A) to (B)
ⓑ CO_2 from (B) to (A)
ⓒ H_2O from (B) to (A)
ⓓ O_2 from (B) to (A)

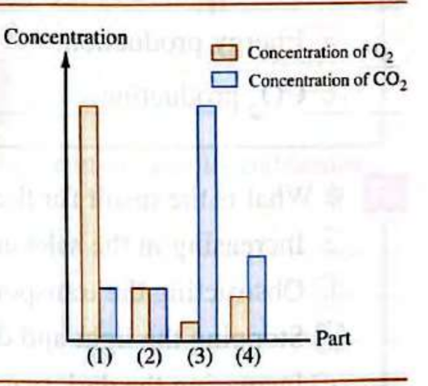
8 ✻ How far are these statements "the lining of small intestine contains villi and the lining of large intestine contains convolutions", "both play an important role in the absorption process" correct ?

ⓐ The two statements are correct.
ⓑ The two statements are wrong.
ⓒ The first statement is correct and the second statement is wrong.
ⓓ The first statement is wrong and the second statement is correct.

9 ✻ If the blood pressure value is 110 / 70 mm Hg, which of the following is synchronized with the measurement of number 110 ?

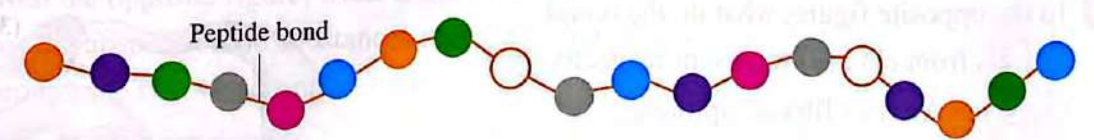
ⓐ The relaxation of ventricles.
ⓑ The contraction of atria.
ⓒ The opening of the valves with flaps.
ⓓ The opening of semi-lunar valves.

10 ✻ The opposite graph represents the concentration of CO_2 and O_2 gases in blood in different body parts, which of the following represents the blood flow through aorta ?



ⓐ (1).
ⓑ (2).
ⓒ (3).
ⓓ (4).

11 Study the following figure, then determine :



Which of the following end(s) the digestion of this compound completely ?

ⓐ Amylase enzyme in duodenum.
ⓑ Pepsin enzyme in stomach.
ⓒ Trypsin enzyme in small intestine.
ⓓ Peptidase enzymes in small intestine.

12 Which of the following substances **can't** be translocated through the phloem or xylem tissues ?

ⓐ Amino acids. ⓑ Sucrose. ⓒ Starch. ⓓ H_2O

13 What is the similarity between the pulmonary artery and the limbs' veins ?

ⓐ The presence of oxygenated blood.
ⓑ The presence of deoxygenated blood.
ⓒ Having the same internal width.
ⓓ Having the same blood pressure value.

14 The following nutrients are found in a piece of candy, which one of them **wouldn't** need to be digested ?

ⓐ Fats. ⓑ Glucose. ⓒ Protein. ⓓ Starch.

15 Which of the following phenomena work on transferring the solutes from and to the cell of a filamentous-shaped alga ?

ⓐ Diffusion and imbibition.
ⓑ Diffusion and active transport.
ⓒ Imbibition and active transport.
ⓓ Diffusion and osmosis.

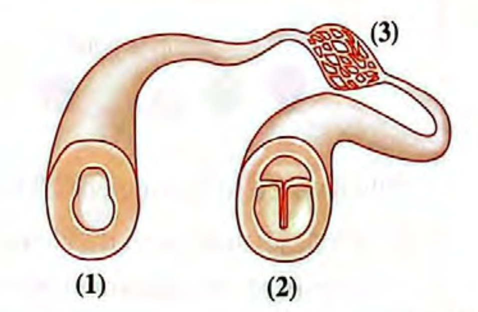
16 Which of the following is accompanied with the formation of glucose 6-phosphate ?

ⓐ Energy production.
ⓑ Energy consumption.
ⓒ CO_2 production.
ⓓ O_2 consumption.

17 * What is the result for the absence of pits from xylem vessels in a plant leaf ?

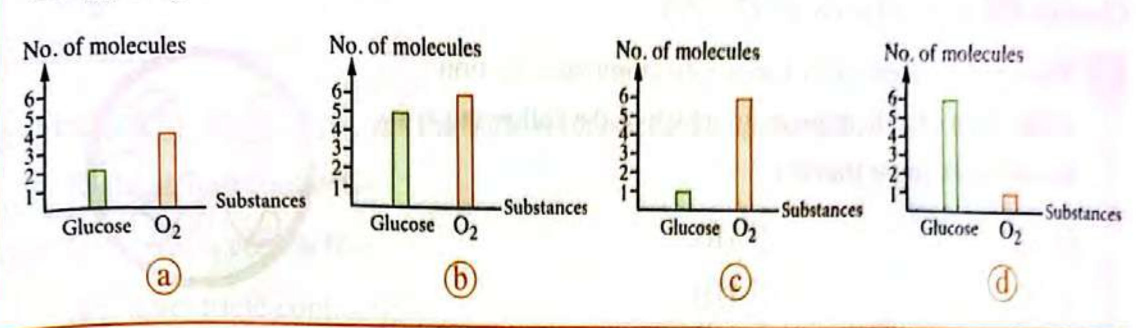
ⓐ Increasing in the salts and H_2O transport to the palisade cells.
ⓑ Obstructing the transport of sucrose and amino acids.
ⓒ Stopping the light and dark reactions.
ⓓ Increasing the dark reactions rate.

18 In the opposite figure, what do the blood vessels from (1) : (3) represent respectively ?



ⓐ Vein / Artery / Blood capillaries.
ⓑ Artery / Blood capillaries / Vein.
ⓒ Blood capillaries / Artery / Vein.
ⓓ Artery / Vein / Blood capillaries.

19 * Which of the following graphs represents the fetus need for glucose and O_2 to produce energy only ?



20 What is the reason for the decrease in the plant absorption of salts when the soil is soaked with water ?

ⓐ Decreasing salts in the soil.

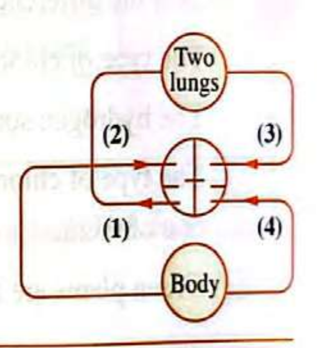
ⓑ Lack of O_2 in the soil.

ⓒ Increasing O_2 in the soil.

ⓓ Increasing in the production of ATP in the root cells.

Answer the following questions (21 : 23) :

21 The opposite diagram represents the blood circulation in human, which contains an arrow with wrong direction. **Determine** its number and name.



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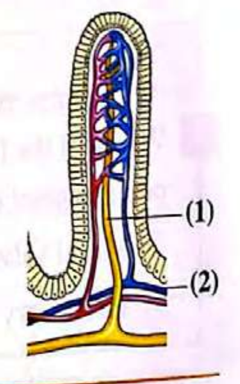
22 **Compare between :** the oxidation process for a piece of sugar in air and its oxidation inside a cell of a living organism's body.

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23 From the opposite figure, **what** is the first blood vessel that the absorbed food substances may be gathered in it through the two vessels no. (1) and (2) ?



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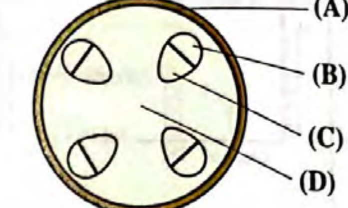
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General Exam 7

Choose the correct answer (1 : 20) :

1 The opposite figure illustrates a diagrammatic section in the stem of a dicot plant, in which of the following tissues does sugar transfer ?



ⓐ (A). ⓑ (B).
ⓒ (C). ⓓ (D).

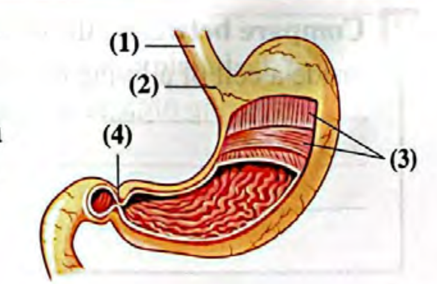
2 Which of the following is found in the blood that is carried by the arterioles inside the lung ?

ⓐ High percentage of wastes.
ⓑ A higher percentage of O_2 and a lower percentage of CO_2
ⓒ A higher percentage of CO_2 and a lower percentage of O_2
ⓓ An equal percentage of CO_2 and O_2

3 What is the difference between the green plants and the purple sulphur bacteria ?

ⓐ The type of chlorophyll in each one of them only.
ⓑ The hydrogen source which is required to reduce CO_2 in each one of them only.
ⓒ The type of chlorophyll and the source of hydrogen required to reduce CO_2 in each one of them.
ⓓ Green plants are autotrophic, while purple sulphur bacteria are saprophytes.

4 Some patients who have digestion complications suffer from the "Gastro-oesophageal reflux" which causes severe inflammation in the oesophagus, in which part in the opposite figure is the disturbance occurred to cause this ?



ⓐ (1). ⓑ (2).
ⓒ (3). ⓓ (4).

5 Which of the following valves determine the blood route which contains the highest percentage of oxyhaemoglobin substance ?

ⓐ Mitral valve and tricuspid valve. ⓑ Mitral valve and aortic valve.
ⓒ Pulmonary valve and aortic valve. ⓓ Bicuspid valve and pulmonary valve.

6 Which of the following substances **doesn't** transfer through the plant transport system ?

ⓐ H_2O ⓑ Glucose. ⓒ Cellulose. ⓓ Mg^{2+}

7 Which of the following gives the highest blood pressure in aorta ?

ⓐ Right atrium contraction.
ⓑ Left atrium contraction.
ⓒ Right ventricle contraction.
ⓓ Left ventricle contraction.

8 The human body contains a group of fluids that differ in their structure, which choice in the following table expresses the components of the blood plasma ?

	Water	Urea	Antibodies
ⓐ	✓	×	✓
ⓑ	✓	✓	×
ⓒ	✓	✓	✓
ⓓ	×	×	✓

✓	Present
×	Absent

9 In the light of your study, what is the similarity between the corn plant and *Orobanche* plant ?

ⓐ Performing photosynthesis process.
ⓑ The fixation of CO_2 gas.
ⓒ Converting low-energy compounds into high-energy compounds.
ⓓ Converting organic compounds into inorganic compounds.

10 In which of the following plants do you expect that the osmotic pressure is vanished ?

ⓐ Cotton. ⓑ Bean. ⓒ Maize. ⓓ *Pinus*.

11 What happens to the ketoglutaric acid when it is converted into succinic acid during cellular respiration ?

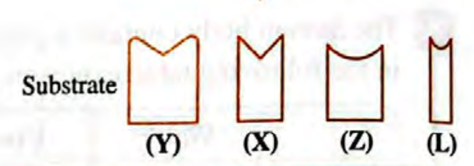
ⓐ It combines with O_2
ⓑ It consumes ATP molecules.
ⓒ It consumes CO_2
ⓓ It loses electrons.

12 Which of the following **doesn't** agree with glycolysis reactions and the reactions which occur in the chloroplast stroma ?

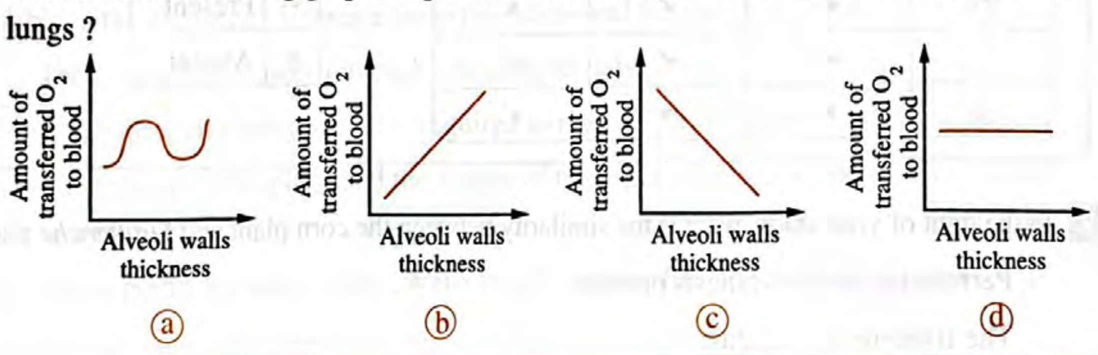
ⓐ Each of them doesn't occur in one step only.
ⓑ PGAL compound is formed in both of them.
ⓒ Both of them need energy.
ⓓ Each of them produces CO_2

13 Which of the following represent the reactants (substrates) for enzymes (A) & (B) respectively ?

ⓐ (Y) & (L).
ⓑ (Z) & (L).
ⓒ (Y) & (X).
ⓓ (X) & (Z).



14 Which of the following graphs expresses the efficiency of air sacs (alveoli) in the two lungs ?



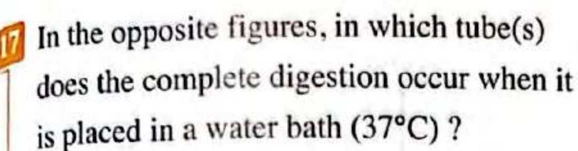
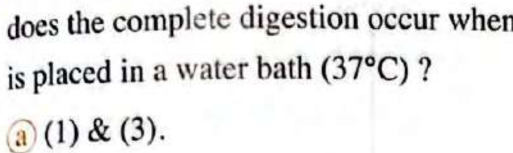
15 Which of the following occurs when placing a plant cell in a salt solution whose temperature is 90°C ?

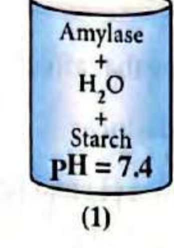
ⓐ Water and salts absorption completely stops.
ⓑ Salts absorption completely stops and water absorption continues.
ⓒ Water and salts absorption partially stops.
ⓓ Water absorption only stops.

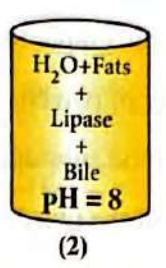
16 What is the result of the presence of a layer of cambium in the stem structure of a dicot plant ?

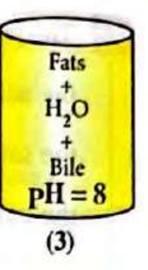
ⓐ An increase in the transport rate.
ⓑ The widening of the secondary xylem cavities.
ⓒ A decrease in the stem support.
ⓓ An increase in the length of phloem tubes.

17 In the opposite figures, in which tube(s) does the complete digestion occur when it is placed in a water bath (37°C) ?







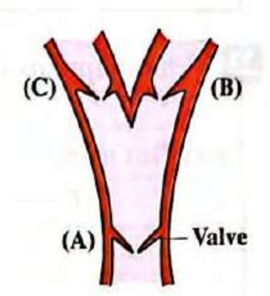
ⓐ (1) & (3).

ⓑ (3) only.

ⓒ (1) & (2).

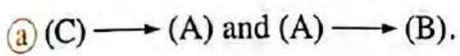
ⓓ (2) only.

18 The opposite figure shows the connection between two veins together, which of the following shows the direction of venous blood ?



ⓐ (C) ⟶ (A) and (A) ⟶ (B).

ⓑ (B) ⟶ (C) and (A) ⟶ (C).



ⓒ (A) ⟶ (C) and (A) ⟶ (B).

ⓓ (C) ⟶ (A) and (B) ⟶ (A).

19 Which of the following tissues is mainly responsible for aeration in the plant leaves ?

ⓐ Palisade tissue. ⓑ Spongy tissue.

ⓒ Collenchyma tissue. ⓓ Vascular tissue.

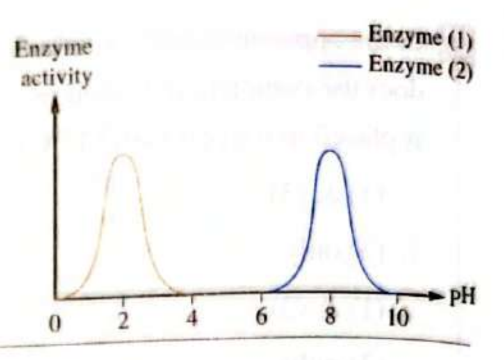
20 * What is the number of the resulted ATP molecules directly from Krebs cycle, starting from a maltose molecule ?

ⓐ 1 ⓑ 2 ⓒ 4 ⓓ 8

Answer the following questions (21 : 23) :

21 **Explain :** lymph plays an indirect role in blood clotting.

22 The opposite graph illustrates the activity of two enzymes that affect the same food substance, **deduce** the name of the two enzymes (1) and (2).



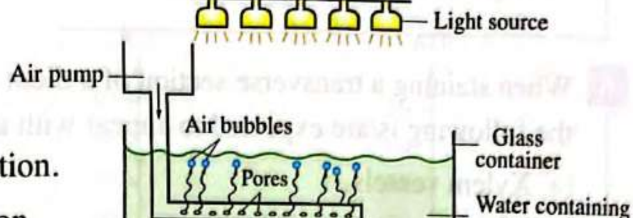
23 **What happens if :** the respiration of the root tissues stops ?



General Exam 8

Choose the correct answer (1 : 20) :

1 In the opposite figure, what is the gas that is supplied to green algae from the air pump ?



ⓐ CO_2 that is required for their respiration.

ⓑ O_2 that is required for their respiration.

ⓒ CO_2 that is required to perform photosynthesis process.

ⓓ O_2 that is required to perform photosynthesis process.

2 * What do you expect when examining a complete blood count for a woman suffering from general weakness, high rate of heartbeats and high respiration rate ?

ⓐ An increase in the number of red blood corpuscles.

ⓑ An increase in the number of white blood corpuscles.

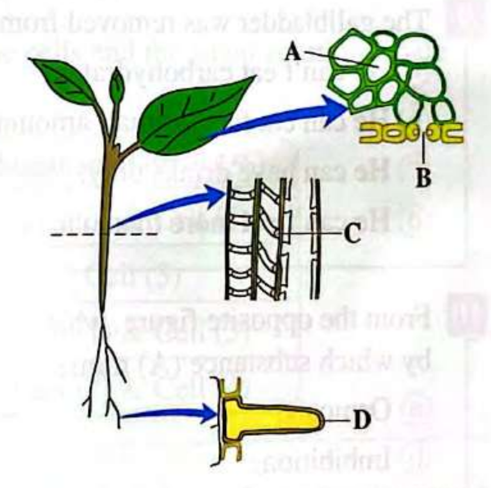
ⓒ A decrease in the number of red blood corpuscles.

ⓓ A decrease in the number of white blood corpuscles.

3 How many main blood vessels that carry oxygenated blood and connected to the heart are found ?

ⓐ 1 ⓑ 2 ⓒ 4 ⓓ 5

4 Which of the following arrows **doesn't** determine the pathway of H_2O molecules in the opposite figure ?



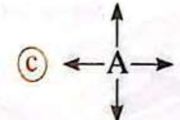
ⓐ D→



ⓑ C↓



ⓒ ←A→ (↑↓)



ⓓ B↓

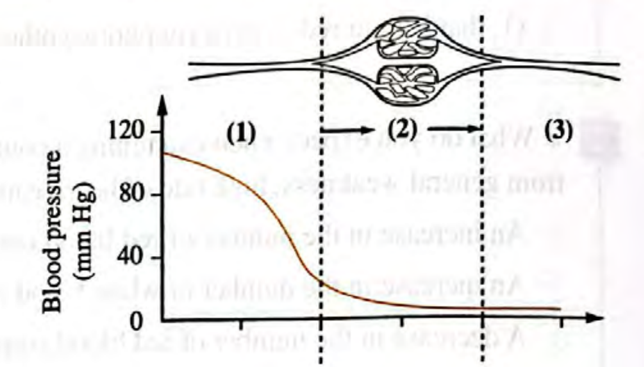
5 Which of the following reactions require the presence of CO_2 gas ?

ⓐ Light reactions only.
ⓑ Dark reactions only.
ⓒ Light and dark reactions.
ⓓ Glycolysis reactions.

6 When staining a transverse section of a dicot plant stem with iodine solution, which of the following is/are expected to appear with a dark blue colour ?

ⓐ Xylem vessels.
ⓑ Companion cells.
ⓒ Cambium.
ⓓ The innermost row of cortex.

7 * The opposite figure illustrates the blood flow in the blood vessels, what does part no. (3) represent ?



ⓐ Artery.
ⓑ Vein.
ⓒ Blood capillaries.
ⓓ Lymphatic vessel.

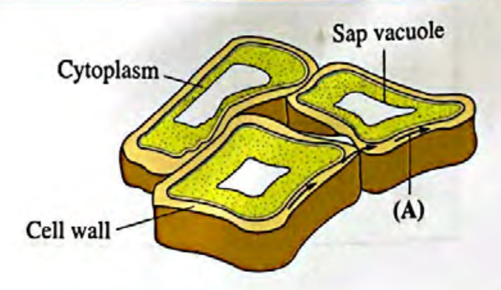
8 What is the ratio between the number of $FADH_2$ molecules to that of NADH molecules that are resulted from the complete oxidation of a glucose molecule in aerobic conditions ?

ⓐ 1 : 5
ⓑ 3 : 1
ⓒ 5 : 1
ⓓ 1 : 3

9 The gallbladder was removed from a person, which of the following is expected to occur ?

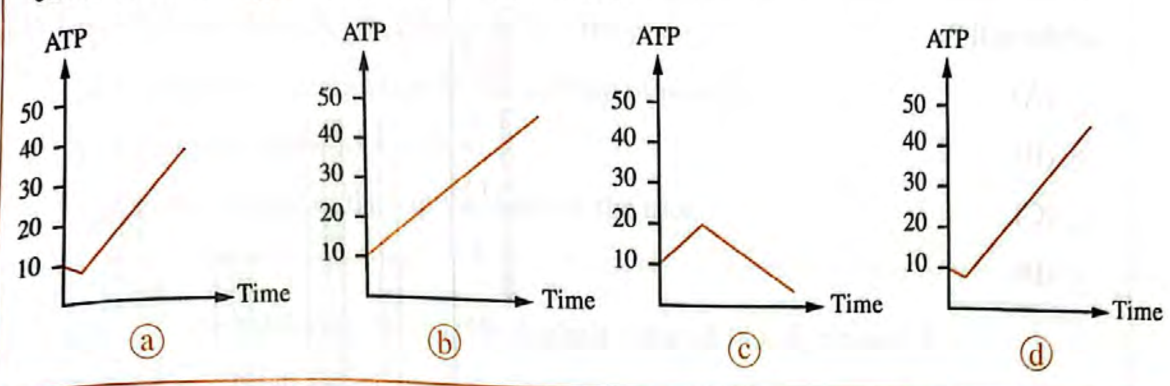
ⓐ He can't eat carbohydrates.
ⓑ He can eat fats in small amounts.
ⓒ He can have drinks only.
ⓓ He can't eat more than one big meal daily.

10 From the opposite figure, what is the phenomenon by which substance (A) transfers ?

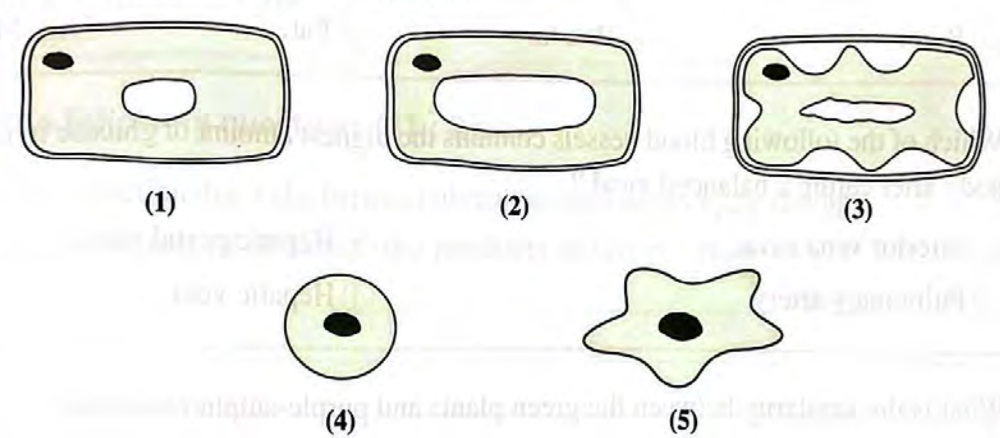


ⓐ Osmosis.
ⓑ Imbibition.
ⓒ Diffusion.
ⓓ Active transport.

11 * If we supposed that the cell storage for energy is 10 ATP molecules, which of the following graphs represents the number of ATP molecules after the aerobic oxidation for one glucose molecule with time ?



12 The following figures show some plant and animal cells after placing them in two sucrose solutions that have different concentrations (knowing that their osmotic pressure = 0.5 % of the sucrose solution) :



Which of the following choices is correct about the cells and the sugar solution where they are placed ?

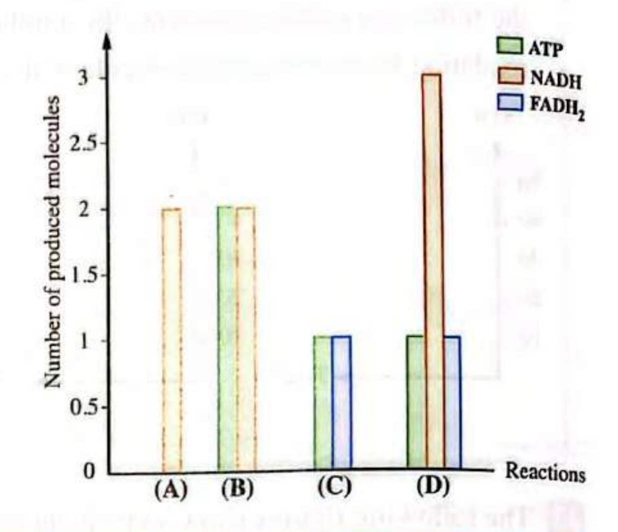
	Sugar solution (1%)	Sugar solution (0.1%)
ⓐ	Cell (1) & Cell (2)	Cell (3) & Cell (5)
ⓑ	Cell (1) & Cell (4)	Cell (3)
ⓒ	Cell (2) & Cell (4)	Cell (1) & Cell (3)
ⓓ	Cell (3) & Cell (5)	Cell (2) & Cell (4)

13 What is the amount of protein that is found in each 100 cm^3 of plasma in a normal person ?

ⓐ 5 g ⓑ 3 g ⓒ 7 g ⓓ 9 g

14 ✱ Study the following graph which shows some products of aerobic cellular respiration reactions :

Which reaction occurs in the cytoplasm of the cell ?



ⓐ (A).

ⓑ (B).

ⓒ (C).

ⓓ (D).

15 Which type of food can be digested in both acidic and alkaline media ?

ⓐ Rice. ⓑ Potato. ⓒ Fat. ⓓ Meat.

16 Which of the following blood vessels contains the highest amount of glucose in the human body after eating a balanced meal ?

ⓐ Inferior vena cava. ⓑ Hepatic portal vein.

ⓒ Pulmonary artery. ⓓ Hepatic vein.

17 What is the similarity between the green plants and purple-sulphur bacteria ?

ⓐ The type of chlorophyll in both of them.

ⓑ The source of hydrogen required for CO_2 fixation in both of them.

ⓒ The dark reactions in both of them.

ⓓ The secondary products of photosynthesis process in both of them.

18 In which of the following vessels the blood clot <u>**can't**</u> be formed, inspite of the presence of the clotting factors inside them ?

ⓐ Arteries. ⓑ Lymphatic vessels.

ⓒ Veins. ⓓ Blood capillaries

19 Normal plants are cultivated in desert and small number of them adapted well with this environment, which of the following factors its increase leads to the well adaptation of these plants ?

ⓐ The tallness of the vegetative system of the plant.

ⓑ Increasing the concentration of the cell sap of root cells.

ⓒ The shortness of the root system.

ⓓ The small volume of the sap vacuoles of the root.

20 In which of the following cases is the highest value of blood pressure ?

ⓐ Relaxation of left ventricle.

ⓑ Contraction of right atrium.

ⓒ Opening the mitral valve.

ⓓ Opening the aortic valve.

Answer the following questions (21 : 23) :

21 There is a reaction that links between glycolysis and Krebs cycle during the cellular respiration, **illustrate the products of this reaction.**

22 **What is the difference between :** the blood capillaries that are present in villi and that are present in the alveoli ?

23 "Stomach has an important role in protecting the human body".

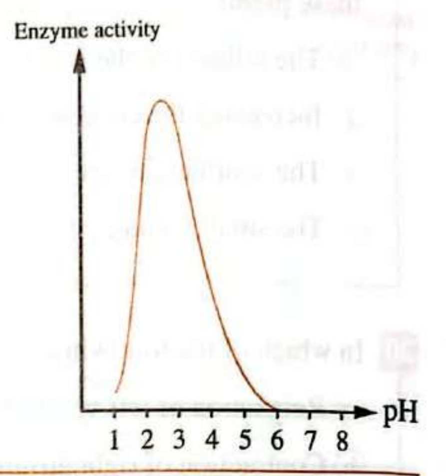
How far is the statement correct ? With explanation.

General Exam 9



Choose the correct answer (1 : 20) :

1 The opposite graph shows the effect of pH on the rate of a digestive enzyme activity, where is the enzyme found ?



ⓐ In bile juice.

ⓑ In gastric juice.

ⓒ In intestinal juice.

ⓓ In pancreatic juice.

2 Which of the following produces the lowest number of ATP molecules ?

ⓐ $FADH_2$ molecule in the electron transport chain.

ⓑ The acidic fermentation.

ⓒ The alcoholic fermentation.

ⓓ One Krebs cycle.

3 Which of the following juices whose action is similar to the action of incisors ?

ⓐ Bile. ⓑ Pancreatic juice.

ⓒ Gastric juice. ⓓ Intestinal juice.

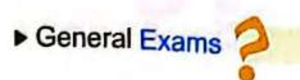
4 ✻ A blood sample was taken from a blood vessel in the patient's body, on examining its external appearance, it was found that its colour is light red. What is the expected place for this sample to be taken from ?

ⓐ A blood vessel near to the skin surface.

ⓑ A blood vessel buried among muscles.

ⓒ Blood capillaries near to the skin surface.

ⓓ Blood capillaries buried among muscles.



5 Which of the following statements **doesn't** explain the transport process of water in the plant ?

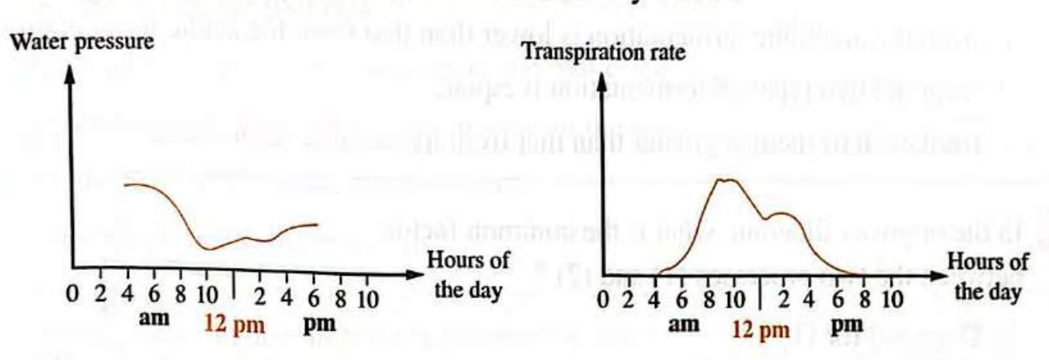
ⓐ Most of the released water from the leaf gets out through the stomata.

ⓑ The cohesion among the molecules of water causes the presence of a continuous column of water.

ⓒ The resulted effect from the transpiration process causes the presence of the continuous attraction of water column.

ⓓ The adhesion force between molecules of water and xylem vessels causes the column of water to be held continuously.

6 The two following graphs illustrate the rate of the transpiration process and the water pressure in the plant leaf cells within the day hours :



What do you conclude from your study to the two previous graphs ?

ⓐ The water pressure decreases inside the leaf cells with increasing the transpiration process.

ⓑ The water pressure increases inside the leaf cells with increasing the transpiration rate.

ⓒ The stomata of the leaf close at 10 am.

ⓓ The stomata of the leaf open at 4 am.

7 What is the process that occurred in the chloroplast and is opposite to the process of the photosynthetic phosphorylation ?

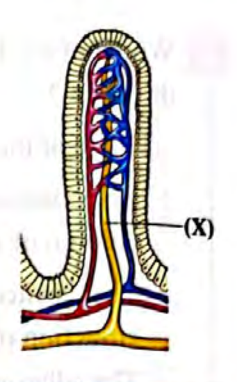
ⓐ The production of ATP from ADP in the grana.

ⓑ The production of ADP from ATP in the grana.

ⓒ The production of ATP from ADP in the stroma.

ⓓ The production of ADP from ATP in the stroma.

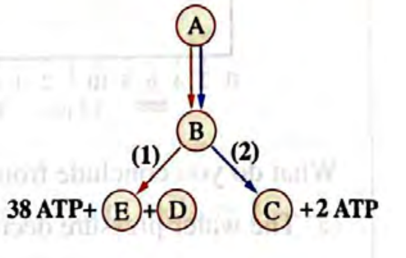
8 Which of the following the decrease in its production rate leads to a decrease in the food substances that are transferred to structure (X) ?



ⓐ Bile juice.
ⓑ Pepsin.
ⓒ Amylase.
ⓓ Sucrase.

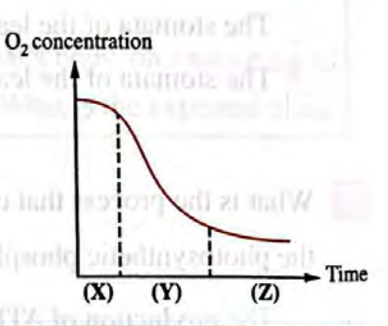
9 In each of the alcoholic fermentation and the acidic fermentation, 2 molecules of ATP are released. So, the expected number of the resulted kilocalories from the hydrolysis of the released ATP molecules ....
ⓐ from the alcoholic fermentation is greater than that from the acidic fermentation.
ⓑ from the alcoholic fermentation is lower than that from the acidic fermentation.
ⓒ from the two types of fermentation is equal.
ⓓ from each of them is greater than that from the aerobic respiration.

10 In the opposite diagram, what is the common factor between the two processes (1) and (2) ?



ⓐ The need for O_2
ⓑ The need for CO_2
ⓒ The need for energy.
ⓓ The need for FAD presence.

11 ✱ What are the blood vessels (X) and (Z) that are expressed in the opposite graph respectively ?



ⓐ Pulmonary artery / Pulmonary vein.
ⓑ Renal artery / Renal vein.
ⓒ Vena cava / Pulmonary artery.
ⓓ Hepatic vein / Hepatic artery.

12 During preparation of a T.S. of a new dicot plant stem, iodine was added to the sample to be more clear, which tissue do you expect its cells <u>**won't**</u> be stained with the dark blue colour ?

ⓐ Cambium. ⓑ Cortex. ⓒ Medullary rays. ⓓ Pith.

13 ✻ Which of the following represents the mechanism of absorbing the products of starch digestion ?

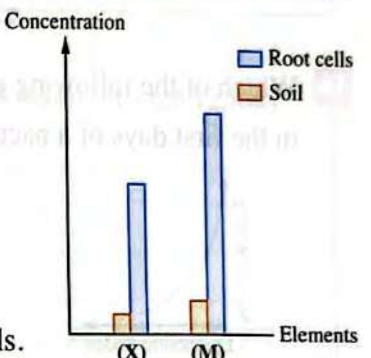
ⓐ Diffusion to the arterioles (arterial capillaries).

ⓑ Active transport to the lacteal vessel.

ⓒ Diffusion to the lacteal vessel.

ⓓ Active transport to the venules (venous capillaries).

14 Study the opposite graph which shows the plant need for (X) and (M) elements to perform vital processes, what is the factor that helps in increasing the concentration of (X) and (M) inside the root cells ?



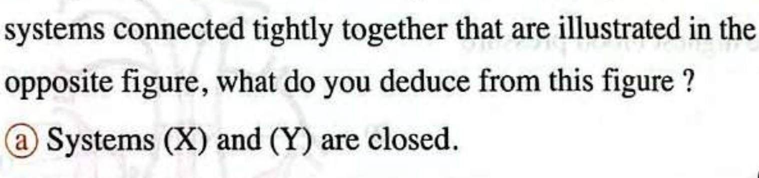
ⓐ Plenty of water inside sap vacuoles of the root cells.

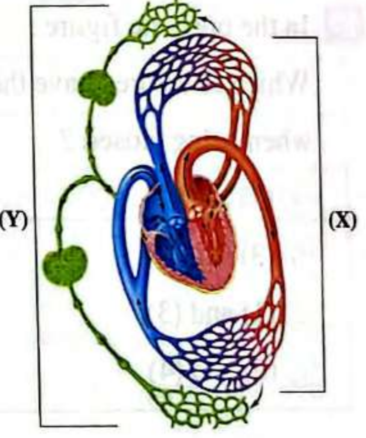
ⓑ The decrease of sugar inside sap vacuoles of the root cells.

ⓒ The decrease of O_2 inside the root cells.

ⓓ Plenty of O_2 inside the root cells.

15 Transport process in human body is occurred by two systems connected tightly together that are illustrated in the opposite figure, what do you deduce from this figure ?





ⓐ Systems (X) and (Y) are closed.

ⓑ Systems (X) and (Y) are opened.

ⓒ System (X) is closed and system (Y) is opened.

ⓓ System (X) is opened and system (Y) is closed.

16 When eating a meal that contains bread, rice and potatoes, what are the enzymes that will digest the three food substances ?

ⓐ Amylase and maltase.

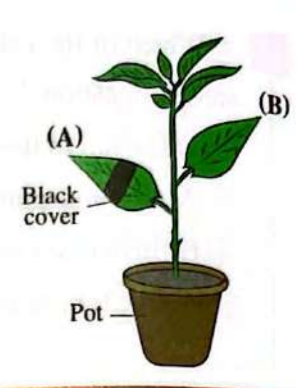
ⓑ Lipase and maltase.

ⓒ Amylase and lipase.

ⓓ Lipase and peptidase.

17 In the opposite figure :

Leaf (B) produces $C_6H_{12}O_6$ .... leaf (A).



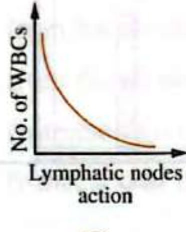
(a) more than

(b) less than

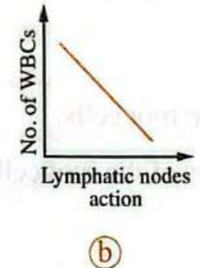
(c) equal to

(d) twice

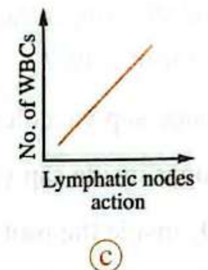
18 Which of the following graphs represents the immunity performance for a person's body in the first days of a bacterial infection ?



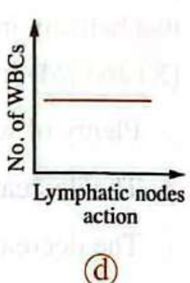
(a)



(b)



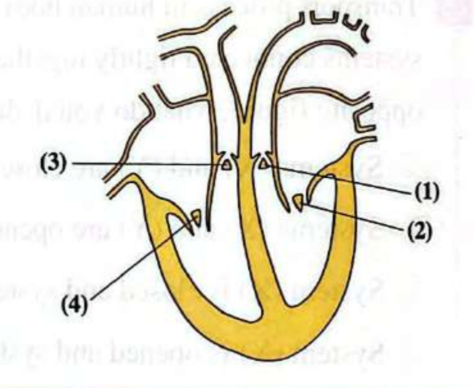
(c)



(d)

19 In the opposite figure :

Which structures have the highest blood pressure when being closed ?



(a) (1) and (2).

(b) (3) and (4).

(c) (1) and (3).

(d) (2) and (4).

20 Which of the following are permeable to water ?

(a) Cellulose walls only.

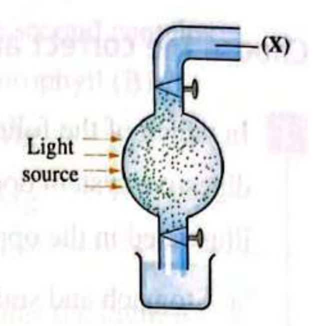
(b) Walls covered by lignin only.

(c) Walls covered by cutin and suberin.

(d) Plasma membranes and cellulose walls.

Answer the following questions (21 : 23) :

21 The opposite figure illustrates the experiment of Calvin, **what do you expect to happen if** the system is supplied with element (X) intermittently ?



____

____

____

22 The doctor may recommend a medicine for the patient, that is taken through venous injection not by mouth. **Suggest two reasons for that.**

____

____

____

____

23 "The aerobic respiration may occur after the anaerobic respiration".
How far is the statement correct ? With explanation.

____

____

____

General Exam 10



Choose the correct answer (1 : 20) :

1 In which of the following parts of the human digestive system does the process that is illustrated in the opposite figure occur ?

Protein → X Y Z L

ⓐ Stomach and small intestine.
ⓑ Mouth and stomach.
ⓒ Oesophagus and small intestine.
ⓓ Mouth, stomach and duodenum.

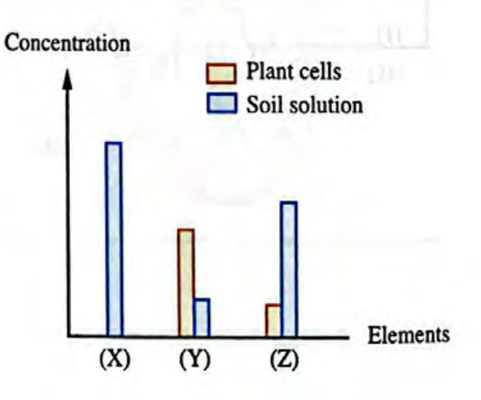
2 Which of the following produces the highest amount of energy ?

ⓐ The oxidation of phosphoglyceraldehyde aerobically.
ⓑ The oxidation of malic acid to oxaloacetic acid.
ⓒ The acidic fermentation of pyruvic acid.
ⓓ The alcoholic fermentation of pyruvic acid.

3 Which of the following can be used as a drug to prevent the formation of blood clots for some patients ?

ⓐ Fibrin.
ⓑ Fibrinogen.
ⓒ Heparin.
ⓓ Thrombin.

4 * The opposite graph illustrates the concentration of elements (X), (Y) & (Z) in the cells of a plant and in the soil solution, which of the following elements does(do) the rate(s) of respiration during its(their) absorption increase ?



ⓐ (X).
ⓑ (Y).
ⓒ (Z).
ⓓ (X) and (Z).

5 Which of the following tissues is **not** present in the leaf of cotton plant ?

ⓐ Mesophyll tissue.
ⓑ Xylem.
ⓒ Phloem.
ⓓ Cambium.

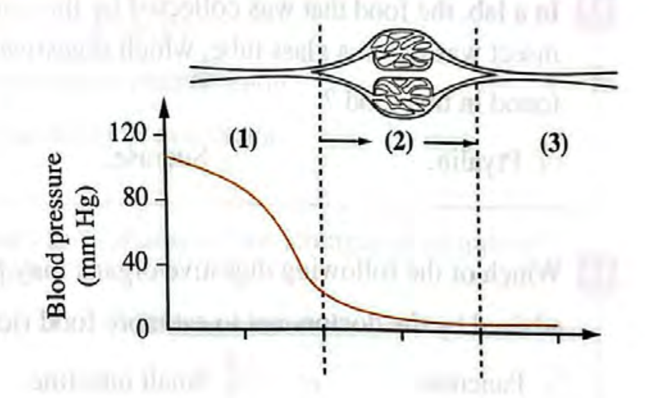
6 If you know that the difference between chlorophyll (A) and chlorophyll (B) is in one chemical group, as the first contains alkyl group (CH_3), while the second contains aldehyde group (CHO). So, what is the molecular formula of chlorophyll (B) ?

ⓐ $C_{55}H_{72}O_5N_4Mg$
ⓑ $C_{54}H_{70}O_6N_4Mg$
ⓒ $C_{55}H_{70}O_6N_4Mg$
ⓓ $C_{55}H_{70}O_4N_4Mg$

7 Which of the following valves direct the blood route which contains the highest percentage of carbo-aminohaemoglobin substance ?

ⓐ Mitral valve and tricuspid valve.
ⓑ Mitral valve and aortic valve.
ⓒ Pulmonary valve and aortic valve.
ⓓ Tricuspid valve and pulmonary valve.

8 * The opposite figure illustrates the blood flow in the blood vessels, what does part no. (1) represent ?



ⓐ Artery.
ⓑ Vein.
ⓒ Blood capillaries.
ⓓ Lymphatic vessel.

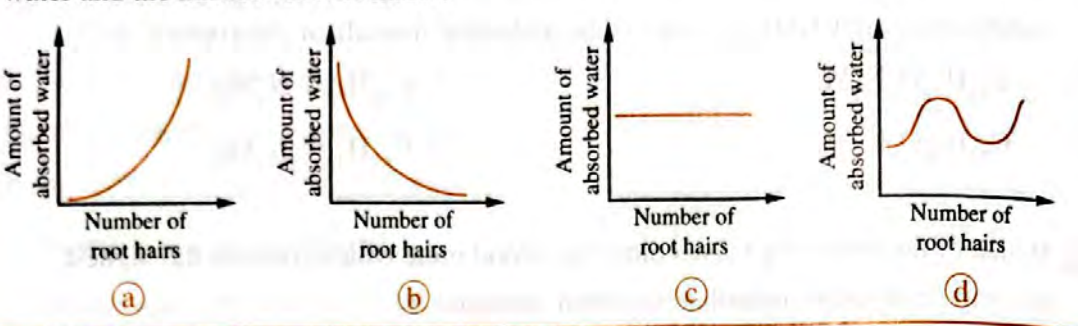
9 Which of the following statements agrees with Krebs cycle ?

ⓐ It is always related to glycolysis process to form pyruvic acid.
ⓑ It occurs inside the mitochondria.
ⓒ It is the biggest direct source to produce ATP molecules in the cell.
ⓓ Pyruvic acid is an intermediate compound in it.

10 What is the phenomenon by which the gas exchange process between the air present inside the alveolus and the blood in the two lungs takes place ?

ⓐ Osmosis.
ⓑ Diffusion.
ⓒ Active transport.
ⓓ Imbibition.

11 Which of the following graphs represents the relation between the amount of absorbed water and the number of root hairs ?



12 * Which of the following blood components can the body make benefit from them through their different stages ?

ⓐ Platelets. ⓑ WBCs. ⓒ Plasma proteins. ⓓ RBCs.

13 In a lab, the food that was collected by the scientist Mittler through the mouth of aphid insect was put in a glass tube, which digestive enzyme can digest the substances that found in this food ?

ⓐ Ptyalin. ⓑ Sucrase. ⓒ Lipase. ⓓ Lactase.

14 Which of the following digestive organs may have dysfunction in a person who is advised by the doctors not to eat more food rich in fats ?

ⓐ Pancreas. ⓑ Small intestine. ⓒ Oesophagus. ⓓ Stomach.

15 How many main blood vessels through which glucose molecule passes after its absorption from small intestine to exit from heart for starting its journey to the brain are found ?

ⓐ 4 ⓑ 6 ⓒ 8 ⓓ 10

16 What is the similarity between the chloroplasts and mitochondria ?

ⓐ The presence of DNA molecules.
ⓑ The presence of NAD^+ molecules.
ⓒ The production of sugar molecules.
ⓓ Glycolysis (splitting of glucose molecules).

17 Which of the following uses sunlight directly ?

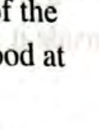
ⓐ Production of ATP molecules.

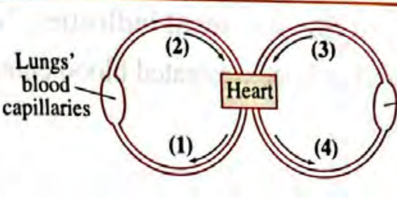
ⓑ Movement of chlorophyll molecule electrons.

ⓒ Water molecules splitting.

ⓓ $NADPH_2$ molecules formation.

18 * In the opposite figure, which of the following blood vessels carry blood at high pressures ?





ⓐ (1) & (2).   ⓑ (1) & (4).

ⓒ (2) & (3).   ⓓ (2) & (4).

19 What is the result of narrowing the xylem tubes diameter in plant stem ?

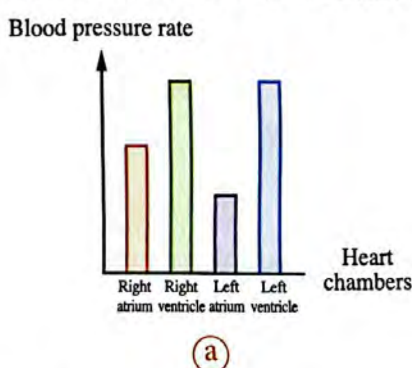
ⓐ The inability of water transfer through xylem tubes.

ⓑ The lignin precipitation inside xylem tubes' cavity.

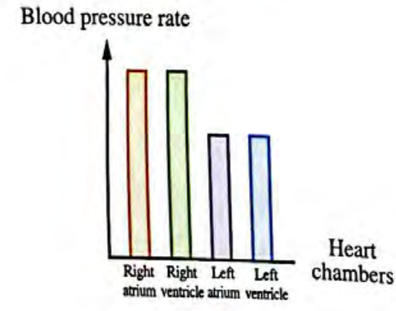
ⓒ Water and salts are transferred by imbibition phenomenon.

ⓓ Water and salts are transferred by capillarity phenomenon.

20 Which of the following graphs expresses the variation of the strength of chambers muscles contraction in the human heart ?



ⓐ



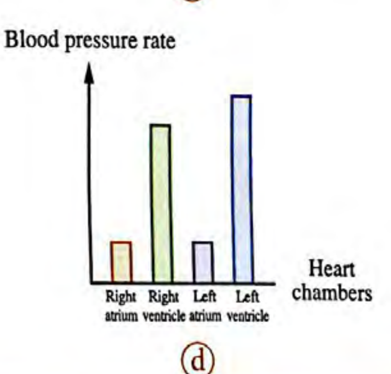
ⓑ

Blood pressure rate

Right atrium Right ventricle Left atrium Left ventricle

Heart chambers

ⓒ



ⓓ

Answer the following questions (21 : 23) :

21 **What** is the least number of each molecule of NADH and $FADH_2$ at which the number of ATP molecules resulted from them is equal ?

---

22 **Write what this statement indicates :** "An organ in the body through which oxygenated and deoxygenated blood enter inside it and the deoxygented blood comes out from it".

---

23 The radioactive carbon has an important role in proving some vital processes inside the plant. **Give two different examples.**



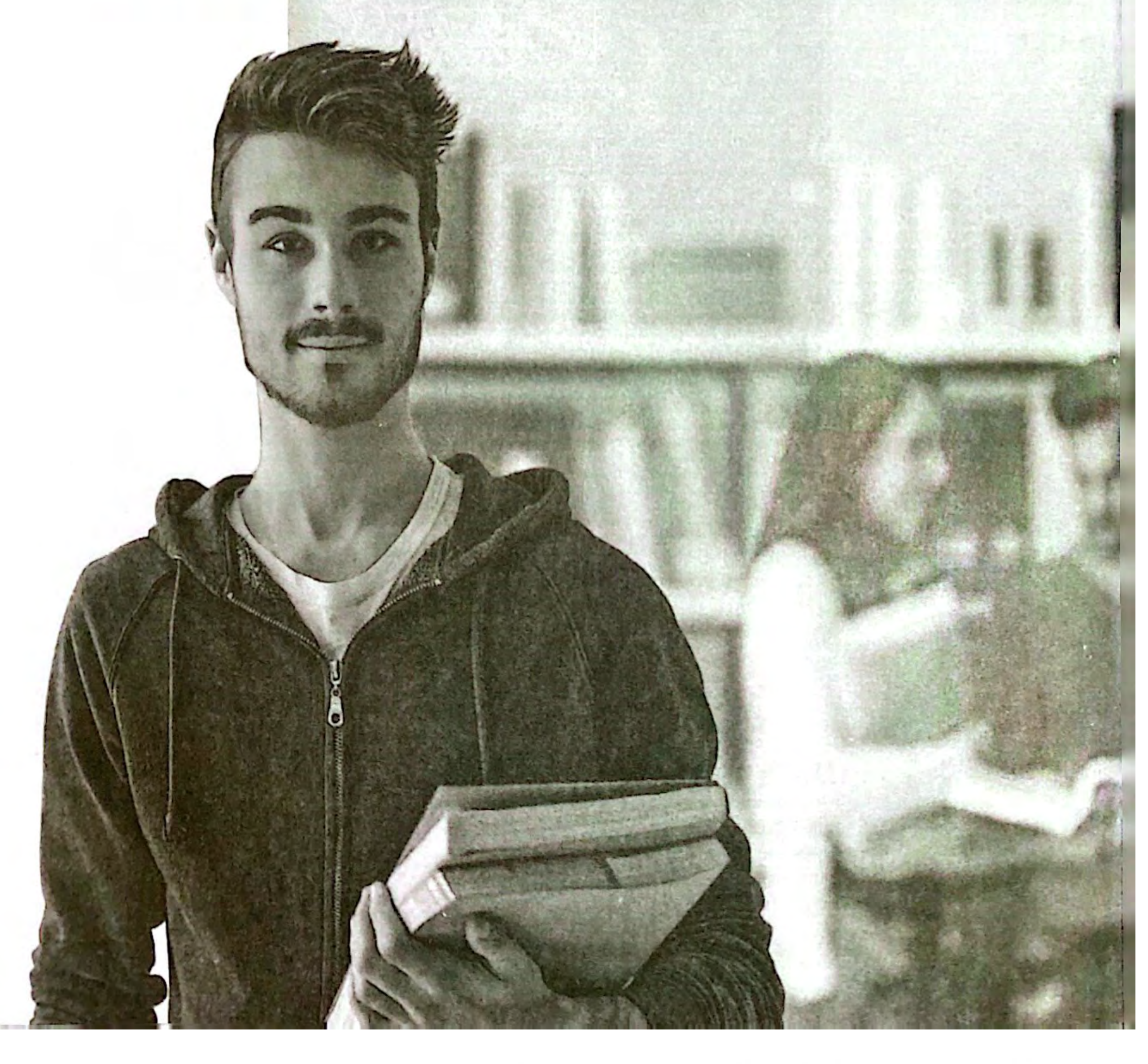
BIOLOGY

By A Group Of Supervisors

Guide Answers

2nd SEC.
2024
FIRST TERM

CONTENTS



Answers of

the Book Questions



Answers of Chapter 1 Lesson One

First Answers of Multiple Choice Questions

1. ⓒ High-energy and complex-structured compounds.
2. ⓒ They obtain their food in the form of simple-structured compounds.
3. ⓓ Parasites.
4. ⓑ Bread mould fungus.
5. ⓒ Corn plant / *Ascaris* worm / Mushroom fungus.
6. ⓓ Increasing its surface area.
7. ⓑ (2).
8. ⓑ The presence of large numbers of mitochondria.
9. ⓑ (2).
10. ⓑ Calcium salts.
11. ⓒ 7% and 2%
12. ⓓ From cell no. (4) to cell no. (1).
13. ⓐ The occurrence of diffusion phenomenon upward and downward.
14. ⓐ The ink molecules move through the membrane by diffusion.
15. (1) ⓓ 90%
    (2) ⓒ 80%
    (3) ⓐ 0%
16. ⓓ Diffusion.
17. ⓓ The cell bursts.
18. ⓒ
19. ⓓ
20. ⓓ The weight of piece (X) decreases and the weight of piece (Y) increases.
21. ⓐ It swells.
22. ⓒ The water molecules move through the carrot tissues to the glass tube.
23. ⓑ
24. ⓓ (3), (2) and (1).
    As cell (3) receives water from the two cells (1) and (2). So, it becomes the highest concentration of salts, i.e. the least concentration of water, followed by cell (2) which receives water from one cell only "cell (1)", and the last one is cell (1) that doesn't receive water from any of the two cells.
25. ⓓ 10%
    Due to the transfer of water from the sap vacuole of the plant cell to outside by osmosis phenomenon when putting it in sucrose solution whose concentration is higher (10%). So, the size of the sap vacuole decreases and the cell shrinks.
26. ⓓ Highly-concentrated salt solution.
    As water transfers from the cells' sap vacuoles of the plant in state (1) to the soil by osmosis phenomenon (i.e. from the medium with high concentration of water to the medium with low concentration of water), causing the wilting of the plant in state (2).
27. ⓒ Water will transfer from left to right.
    As the concentration of water in the left side is (94%) higher than that of the right side (90%). So, water transfers from left to right by osmosis phenomenon through the semi-permeable membrane.
28. ⓐ Osmosis.
29. (1) ⓑ Diffusion.
    (2) ⓐ Osmosis.
30. ⓑ Nitrogen.
31. ⓒ Iodine.
32. ⓓ 2.1×10^3 ion/liter.
33. (1) ⓒ The plant doesn't need it.
    (2) ⓒ Active transport. (3) ⓐ Iron.
    (4) ⓐ The plant needs element (Y) more than element (Z).
34. ⓓ (1), (2), (3) and (4).
35. ⓓ Increases / Osmosis.
    As water transfers from the diluted sucrose solution to the cells of the potato piece by osmosis. So, the concentration of sucrose increases in the solution.

Second Answers of Miscellaneous Questions

1. As cotton plant is from the green plants that manufacture their food by themselves, where it synthesizes the high-energy complex-structured organic food substances from the low-energy

simple-structured raw inorganic materials inside its cells through the photosynthesis process, while the bread mould fungus obtains the high-energy organic food substances from the bodies of the other living organisms by saprophytism.

2

Bean plant	*Orobanche* plant
• Autotrophic living organism. • It obtains its food by chemical reactions that occur inside its cells and are known as "photosynthesis".	• Heterotrophic living organism. • It obtains its food from the bodies of the other living organisms by parasitism.

3 As the concentration of the solution (cell sap) inside its sap vacuole is higher than the concentration of soil solution. This helps water to pass from the soil to the cell by osmosis.

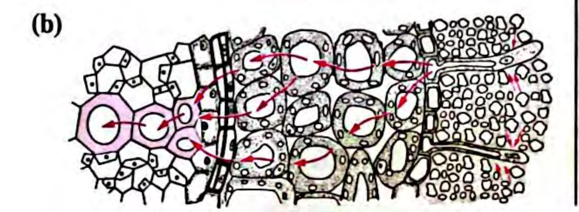
4 (a) It may lead to tearing each of structure no. (1) "piliferous layer (epidermis)" and structure no. (3) "root hair" and the compensation occurs continuously from the elongation zone in the root.

(b) The concentration of ions will increase inside structure no. (2) "sap vacuole", due to the decrease of water in the soil.

(c) The surface area of water and salts absorption from the soil decreases, as well as the fixation of plant in the soil decreases, due to the inability of penetration and sliding among the soil particles and sticking to them which may lead to the death of the plant.

5 (a) (1) Soil particles. (2) Root hair.
(3) Piliferous layer "root epidermis".
(4) Xylem vessels.

(b)



(c) 1. As structure no. (2) "root hair" secretes a viscous substance that helps it in penetrating structure no. (1) "soil particles".

2. As structure no. (2) "root hair" is characterized by :

- Being large in number and protruding outside the root to increase the surface area of water and salts absorption.
- Having thin wall to permit the passage of water and salts through it.
- The solution concentration inside its sap vacuole is more than that of the soil solution to help in passing water from the soil to the root hair.

(d) The carbohydrates will not be converted into proteins.

6 **The statement is wrong /** As the cell walls mainly consist of cellulose that is permeable to water and mineral salts ions, while the selective permeability is a phenomenon which characterizes the plasma membranes.

7 As the presence of a difference in the concentration of soluble substances in water in both sides of the semi-permeable membrane arises an osmotic pressure which leads to the passage of water from the low-concentrated solution to the high-concentrated solution by osmosis.

8 **The statement is wrong /** As the difference in osmosis among plant cells results in a difference in osmotic pressure, while water moves from the cells with high concentration of water to the cells with low concentration of water by osmosis phenomenon.

9 As forcing ions to diffuse from outside the cell "low concentration" to inside the cell" high concentration" against the concentration gradient requires chemical energy that is known as active transport.

10 In tube no. (1), the seedling appears yellow in colour, because the nutritive solution doesn't contain the essential elements (macro and micro-nutrients) that are needed to the seedling growth, while in tube no. (2), the seedling appears green in colour, because the nutritive solution contains the essential elements needed to the seedling growth.

Answers of questions that measure high levels of thinking

1 ⓐ The glucose concentration in the beaker will increase.

As the glucose transfers from the sac to the beaker with the concentration gradient by diffusion, therefore its concentration increases in the beaker and decreases in the sac till it reaches the equilibrium where the glucose concentration inside the sac becomes equal to its concentration inside the beaker. Also water moves from the higher concentration in the beaker (low solution concentration) to the lower concentration in the sac (high solution concentration) by osmosis, therefore the water content inside the sac increases (i.e. the sac volume increases) and the water content in the beaker decreases till it reaches the equilibrium state.

2 ⓑ 2%

As no change occurs in the weight of the potato piece (7g) at this concentration (2%).

3 ⓑ plasma membranes.

As the plasma membranes of the plant cells prevent the passage of sugars from the soil, while its cell walls allow the passage of water and salts ions only that the plant uses in the formation of sugars inside its cells during the photosynthesis process.

4 ⓐ Cell (A) only.

As the concentration of molecules outside cell (A) is lower than its concentration inside it. Therefore, the need of the cell to these molecules requires an energy to be transferred against the concentration gradient, and this energy is taken from ATP molecules.

5 ⓒ Phosphorus.

As phosphorus element enters in the formation of the required energy transferring compounds (ATP) that are required for the active transport of the ions which are absorbed against the concentration gradient.

6 (1) ⓑ 2%

As the solution level inside the funnel that contains starch solution (2%) doesn't change after 24 hours.

(2) ⓐ Osmosis phenomenon.

As the level of the solution inside funnel no. (3) that contains starch solution (4%) increases, while that of the solution inside funnel no. (1) which contains tap water decreases, due to the transfer of water through the semi-permeable membrane by osmosis phenomenon from the medium with high concentration to the medium with low concentration for water molecules.

Answers of Chapter 1 Lesson Two

First Answers of Multiple Choice Questions

1 ⓓ Chlorenchyma tissues.

2 ⓑ O_2

3 ⓐ CO_2

4 ⓐ Z

5 ⓐ Cutin.

6 ⓒ Layer that is impermeable to water.

7 (1) ⓑ (2). (2) ⓒ (2) and (4). (3) ⓑ (2).

8 ⓓ The leaves are getting more yellow in colour.

9 ⓓ

10 ⓑ $A + C \xrightarrow{\text{Sunlight}} B + D$

11 ⓒ The light intensity is very low.

12 ⓓ Energy to produce oxygen, water and glucose.

13 ⓑ The site of stomata.

14 ⓐ $6CO_2 + 6H_2O \xrightarrow[\text{energy}]{\text{Light}} C_6H_{12}O_6 + 6O_2\uparrow$

As 6 molecules of carbon dioxide and 6 molecules of water are needed to form the glucose molecule (6C).

15 ⓒ Light + Chlorophyll + ADP

16 ⓓ ADP from ATP in stroma.

17 ⓑ Formation of glucose.

18 ⓒ (a) and (b) respectively.

19 ⓒ ATP

20 ⓐ $NADPH_2$ and ATP



21 ⓐ In grana and stroma respectively.

22 ⓓ Formation of simple sugars.

23 ⓒ Splitting of hydrogen sulphide / Formation of water.

24 ⓒ Formation of ADP

25 ⓐ Formation of a 3-carbon compound.

26 ⓑ By combination of carbon dioxide with hydrogen.

27 ⓑ Glucose containing ^{16}O

28 ⓓ 6

29 ⓒ Formation of oxygen.

30 ⓓ $C_6H_{12}O_6$

31 ⓐ

32 ⓑ CO_2 fixation.

33 ⓒ From light to chemical / Glucose / Starch

34 ⓓ

35 ⓒ Resulted from the photosynthesis process.

36 (1) ⓑ H_2O (2) ⓑ ADP
(3) ⓐ $NADPH_2$ (4) ⓐ Grana / Stroma.

37 ⓓ In grana and stroma together.
As NADP compound is reduced to $NADPH_2$ in grana, to carry hydrogen to stroma, where it combines with CO_2 gas to be reduced into carbohydrates. Therefore, the reduction reactions take place in grana and stroma together inside the chloroplast.

Second Answers of Miscellaneous Questions

1 Because it contains chlorenchyma tissues that contain chloroplasts.

---

2 (a) Chlorophyll (A), chlorophyll (B), xanthophyll and carotene.
(b) As the ATP and $NADPH_2$ compounds that are formed in structure no. (5) "grana" during light reactions are carried to structure no. (1) "stroma" for accomplishing the dark reactions, where carbon dioxide gas is fixed by its combination with the hydrogen that is carried on $NADPH_2$ compound by the help of the stored energy in ATP molecule, leading to the formation of carbohydrates.
(c) 1. (3) DNA 2. (1) Stroma.
3. (4) Starch granules.

3 The plant will die, due to the non-occurrence of photosynthesis process, because of :
- The stopping of the light reactions occurrence, due to the absence of the needed chlorophyll for absorbing light energy.
- The non-occurrence of dark reactions, due to the non-formation of ATP and $NADPH_2$ that are required for the fixation of CO_2 gas and the formation of carbohydrates.

---

4 *Answer by yourself.*

---

5 The plant will die, due to the inability to translocate the dissolved organic food substances from the mesophyll tissue where they had been manufactured to the different plant parts.

---

6 **The statement is wrong** / As during the photosynthesis process the green and purple sulphur bacteria use hydrogen sulphide as a source of hydrogen that is used in reducing CO_2 to build carbohydrates. So, sulphur is released and not oxygen.

---

7 **The statement is wrong** / As most types of bacteria are heterotrophic organisms, because they don't contain the bacteriochlorophyll that enables them to perform the photosynthesis process.

---

8 **The statement is correct** / As a group of scientists used the oxygen isotope (^{18}O) instead of (^{16}O), in order to prove that water is the source of the evolved oxygen in the photosynthesis process, as well as Calvin used the radioactive carbon isotope (^{14}C) to reveal the nature of dark reactions and prove that the first stable compound that formed in the dark reactions is the phosphoglyceraldehyde (PGAL).

---

9 **The statement is wrong** / As dark reactions are called the enzymatic reactions, i.e. they need enzymes (co-factors) to occur.

---

10 (a) In the grana inside the chloroplast.

(b) In case of the absence of (D) "NADP", (B) "hydrogen" may escape or recombine with (C) "oxygen" again.

(c) Dark reactions will not occur, therefore carbohydrates will not be formed, due to the absence of hydrogen that is carried on compound (E) "$NADPH_2$" that is required to fix the carbon dioxide gas.

---

11 The ability of sulphur bacteria to perform photosynthesis process will decrease, as hydrogen sulphide is the source of the hydrogen needed to fix CO_2 in dark reactions to form carbohydrates.

---

12 **The statement is correct** / As the kinetic energy of light that falls on the molecules of chlorophyll is stored as chemical potential energy when released, a part of this energy is used in the combination of ADP molecule with a phosphate group to form an ATP molecule, and this is known as the "photosynthetic phosphorylation".

---

13 The efficiency of photosynthesis process will decrease, where the rate of dark (enzymatic) reactions will decrease, because the limiting factor here is the temperature. So, the fixation of carbon dioxide will decrease, therefore the carbohydrates formation will decrease which affects the plant life.

---

14 As ATP and $NADPH_2$ compounds are produced from the light reactions of the photosynthesis process and during the dark reactions in the stroma, CO_2 gas is fixed by its combination with the hydrogen which is carried on $NADPH_2$ compound and by the help of the stored energy in ATP molecule. So, carbohydrates will be formed.

---

15 **The statement is wrong** / As the high-energy organic substances are formed during the dark reactions in stroma by the help of ATP and $NADPH_2$ compounds that were formed during the light reactions in grana.

16 **(a)** The direction of the arrow towards the label no. (1) "outside"/ As it represents CO_2 gas that is needed by the alga to accomplish the photosynthesis process.

(b) The phosphoglyceraldehyde (PGAL) compound will not be formed, because of the absence of light "no. (4)" that is needed by the alga to perform the photosynthesis process.

---

17 **(a)** In the chloroplast.

(b) • (B) : Light reactions.
• (C) : Dark reactions.

(c) • (B) : Light.
• (C) : Temperature.

(d) • (A) : Water.
• (D) : H_2
• (E) : Glucose.

---

18 As the plant uses the phosphoglyceraldehyde (PGAL) compound that is resulted from the dark reactions in the synthesis of different organic compounds, such as glucose, starch, proteins and lipids.

---

19 **(a)** • (A) : O_2 gas. • (B) : ATP
• (C) : $NADPH_2$

(b) *Answer by yourself.*

(c) The mesophyll tissue of the leaf / As it consists of the palisade layer and spongy layer, and the cells of each layer contain chloroplasts whose stroma contains a large number of starch granules (E).

Answers of questions that measure high levels of thinking

1 ⓑ The *Cuscuta* plant is devoid of chlorophyll and the *Medicago sativa* plant contains real roots.

As the parasitic plant (*Cuscuta*) doesn't need real roots to absorb water and salts and also doesn't need chlorophyll to perform photosynthesis process, but it depends on the host plant (*Medicago sativa*) in getting its food in a ready-made form.

2 ⓐ Palisade tissue.

As the palisade tissue contains many chloroplasts that contain the chlorophyll pigment that is required for performing the photosynthesis process, to produce a high percentage of starch, while the spongy tissue contains a lower number of chloroplasts, whereas the chloroplasts are absent from the xylem and phloem tissues.

---

3 (1) ⓒ (3) and (9).

As number (3) "xylem vessels" (non-living cells) and number (9) "xylem parenchyma" (living cells) share in the formation of xylem tissue (compound tissue).

(2) ⓒ (6) and (7).

As the parenchyma cells (6) "spongy tissue" share with the parenchyma cells (7) "palisade tissue" in performing the photosynthesis process, because they contain chloroplasts.

---

4 ⓐ It is more green than its lower surface.

As the upper surface of the leaf is followed by the palisade tissue whose cells are crowded by chloroplasts, while above the lower surface the spongy tissue is present, as its cells contain a lower number of chloroplasts than that in the palisade tissue cells.

---

5 ⓐ

As PGAL compound formation depends on the reduction of CO_2 gas. So, in case of the removal of CO_2 gas, this compound will not be formed. Therefore, its level decreases, while the light blocking or light increasing doesn't affect the amount of PGAL, because dark reactions take place in light and darkness.

---

6 ⓑ Absence of CO_2 / Absence of chlorophyll / Absence of light

As the absence of CO_2 gas occurred as a result of the presence of the 2 glass sheets in the plant leaf in case no. (1), the absence of chlorophyll from the yellow parts of the leaf in case no. (2) and the non-exposure of the part of the leaf in case no. (3) to light as a result of the presence of the black barrier that prevents the occurrence of photosynthesis process. Therefore, the non-formation of starch leads to unchanging the colour of iodine solution.

---

7 ⓑ The occurrence of dark reactions is conditioned by the occurrence of light reactions.

As the occurrence of dark reactions depends on the occurrence of light reactions, where the products of light reactions complete their action in the dark reactions to form carbohydrates.

---

8 ⓒ Oxygen enters in the structure of all the photosynthesis products.

As oxygen enters in the structure of all the photosynthesis products (carbohydrates, water and CO_2 gas), while carbon enters in the structure of carbohydrates that are intended to be studied.

---

9 As when light falls on the molecules of chlorophyll, the electrons of their atoms become excited to move from their lower energy levels to the higher energy levels, therefore the kinetic energy of light is stored as chemical potential energy in the chlorophyll, and on releasing this energy, a part of it is used in the formation of ATP molecules that store chemical energy in the chemical bonds among their atoms.

---

10 The iodine solution doesn't change, on adding it to the leaf part that is present inside the glass jar, as the concentrated potassium hydroxide solution absorbs CO_2 gas from the air that is present inside the jar, which prevents the occurrence of photosynthesis process, while the colour of iodine solution changes in the leaf part that was exposed to light outside the glass jar from brown colour to dark blue colour, as the plant performed the photosynthesis process, and starch is formed in this part of the leaf.

Answers of Chapter 1 Lesson Three

First Answers of Multiple Choice Questions

1 ⓓ absorbed.

2 ⓐ It stops.

3 ⓐ Enzymes (1) and (2) are the same.

4 ⓒ Amylase.

5 ⓐ Mouth.

6 ⓓ Maltose.

7 ⓒ Pastries.

8 ⓐ A

9 ⓓ Decreasing the pH value to 2

10 ⓒ Eggs.

11 ⓑ

As the starch molecule is digested in mouth by the action of amylase enzyme into maltose that is a disaccharide sugar consisting of two glucose molecules linked together.

12 ⓒ Due to the difference in pH

13 ⓑ Fats.

14 ⓒ Bile.

15 ⓓ In small intestine.

16 ⓒ Peanut butter.

17 ⓐ Lipase.

18 ⓐ Pancreas.

19 ⓑ Lipase.

20 ⓑ Enterokinase.

21 ⓓ Lactase.

22 ⓓ Amylase and maltase.

23 ⓒ Gastric juice.

24 ⓓ Trypsin enzyme is secreted in an active form, while pepsin enzyme is secreted in an inactive form.

25 ⓑ Stomach / Ileum.

26 ⓒ Oesophagus.

27 ⓓ Minerals and vitamins.

28 ⓐ Liver.

29 ⓓ Trypsin / Trypsinogen.

30 ⓓ Stomach.

31 ⓓ In small intestine.

32 ⓐ Amino acids and simple sugars.

33 ⓑ Proteins / Polypeptides

34 ⓒ Sucrose molecule / Sucrase enzyme / Glucose molecule

35 ⓓ Bile juice and maltase.

As pepsin and trypsin act on the digestion of proteins, ptyalin and pancreatic amylase act on the digestion of starch and each of HCl acid and enterokinase enzyme acts on the activation of pepsinogen and trypsinogen respectively, but the bile juice hydrolyzes fats, while maltase hydrolyzes maltose sugar.

36 ⓑ Amylase.

As each of maltase, sucrase and lactase digests disaccharides which are maltose, sucrose and lactose respectively, while amylase digests polysaccharides which is starch.

37 ⓒ Pepsin – Trypsin – Peptidases – Lactase.

As pepsin and trypsin act on the digestion of proteins in milk and their action is completed by the action of peptidases to make the body benefit from amino acids, while lactase enzyme hydrolyzes lactose sugar in milk to make the body benefit from glucose and galactose.

38 ⓑ 2

39 ⓑ Butter.

40 ⓒ Fats.

41 ⓒ Enterokinase.

42 ⓒ Because it is required to an amount of energy to be absorbed.

43 ⓐ Anabolism.

44 ⓓ The body benefits from it as a source of energy.

45 ⓓ Superior vena cava.

As vitamin (B) dissolves in water. So, it takes the blood route during the absorption process, where it passes in the hepatic portal vein, then to liver and from it to the hepatic vein to be emptied in the inferior vena cava, then to the heart, while the superior vena cava is a path of the lymphatic route for the absorption process.



46 ⓒ bile and pancreatic juice

As the bile acts on the digestion of fats into emulsified fats that are hydrolyzed by the action of lipase enzyme (that is present in the pancreatic bile) into glycerol and fatty acids which pass in the lymphatic route to be absorbed with those vitamins which dissolved in it.

Second Answers of Miscellaneous Questions

1 The body will not be able to digest the large and complex-structured food molecules (carbohydrates, proteins and fats) into small-sized and simple-structured molecules which are easily entered and absorbed by the cell. Therefore, the body will not be able to benefit from them.

---

2 The action of the enzyme will be affected by increasing the temperature, as each enzyme has an optimum temperature at which it works efficiently. So, if the temperature increases above or decreases below this temperature, the enzyme activity will decrease gradually till it will stop.

---

3 As the enzyme that catalyzes the breaking down of a complex molecule into two simpler molecules, also it may be able to reunite the two molecules again into the same complex molecule.

---

4 Human will feel the sweet taste, due to the change of starch in the piece of bread into maltose sugar by the action of amylase (ptyalin) enzyme that is present in saliva.

---

5 Due to the secretion of mucus and the continuity of peristalsis process along the alimentary canal.

---

6 The food will pass into the trachea, and this will lead to the human suffocation, as during the swallowing of food, the top of trachea and the larynx are elevated together, causing the epiglottis to close over the glottis.

7 (a) Along the alimentary canal / Peristalsis.

(b) By a series of muscular contractions and relaxations of the muscles of the alimentary canal.

(c) Sweeping, churning and mixing the food with the digestive juices along the alimentary canal.

---

8 Because the salivary glands pour saliva into the buccal cavity which contains mucus that softens the food and facilitates its swallowing, as well as the lining of oesophagus contains glands which secrete mucus.

---

9 As HCl acid creates acidic medium in the stomach (pH = 1.5 : 2.5) which leads to the activation of pepsinogen enzyme and changing it into active pepsin to digest proteins.

---

10 The gastric medium will not be acidic. So, the action of ptyalin enzyme will continue, the harmful bacteria that enter with food will not be killed, as well as the pepsinogen enzyme will not be activated. So, the protein will not be digested.

---

11 *Answer by yourself.*

---

12 (a) Structure no. (3) "stomach muscles" participate in the digestion process through a group of muscular contractions and relaxations "peristalsis" that sweeps, churns and mixes the food with the gastric juice.

(b) The functional suitability of structure no. (1) "oesophagus" :

- Its lining contains glands that secrete mucus for softening the food and facilitating its passage.
- Its internal wall contains muscles that perform the peristalsis to sweep the food bolus to the stomach.

(c) The opening and closing of structure no. (2) "cardiac sphincter" and structure no. (4) "pyloric sphincter" are controlled by sphincter circular muscle.

13 As the gastric juice contains inactive pepsinogen enzyme that is converted by the action of HCl acid into active pepsin that hydrolyzes the proteins (red meat) into short polypeptide chains, and doesn't contain digestive enzymes that affect the other types of food substances.

---

14 This will affect the stomach cells, then it will digest the stomach internal walls and this may cause the stomach ulcer.

---

15 Due to the presence of HCl acid which stops the action of amylase (ptyalin) enzyme, as HCl acid creates an acidic medium in the stomach (pH = 1.5 : 2.5), while the ptyalin enzyme works in a weak alkaline medium (pH = 7.4).

---

16 This experiment will be carried out again, where :

- The temperature of the water bath is adjusted at 37°C.
- Using diluted HCl with pH = (1.5 : 2.5).

---

17 Due to the stopping or reducing of heavy mucous secretions from the internal walls of stomach. So, these walls will be affected by the action of digestive juices (gastric juice), and this will lead to the inflammation of the stomach and the occurrence of stomach ulcer.

---

18 Due to the presence of pepsinogen enzyme in an inactive form and it is not activated unless it comes out from the stomach cells into its cavity by the action of HCl acid, as well as the heavy mucous secretions that cover the internal wall of the stomach protect it against the digestive juices.

---

19 Because it doesn't contain any digestive enzymes.

---

20 As the liver secretes the bile juice during the passage of food in the duodenum which works on changing the fats into emulsified fats. So, it facilitates and accelerates the enzymatic action on the fats that don't dissolve in water.

21 The digestion of fats and making benefit from them become difficult, because the bile juice converts the fats into emulsified fats to facilitate and accelerate the enzymatic action on fats that don't dissolve in water.

---

22 Because in the small intestine, sodium bicarbonate is secreted which changes the pH of the medium into alkaline (pH = 8). So, the action of pepsin enzyme stops, as it works in an acidic medium (pH = 1.5 : 2.5) as in the stomach.

---

23 HCl acid will not be neutralized inside the duodenum and the medium will not be alkaline that leads to the continuity of pepsin enzyme action and stopping the enzymes of the pancreatic juice (amylase, trypsinogen and lipase) which work in an alkaline medium that affect the digestion process.

---

24 Because it works on converting the trypsinogen enzyme (inactive form) into the trypsin enzyme (active form) which breaks down the proteins into polypeptides.

---

25 Both of them activate the digestive enzymes for proteins to be converted into polypeptide chains.

---

26 **The statement is wrong /** As fast food meals contain a large amount of fats and this stimulates the activity of bile juice to convert them into emulsified fats, which facilitates and accelerates the action of lipase enzyme on fats and converts them into fatty acids and glycerol.

---

27 As the trypsin enzyme has a limited effect on the digestion of protein substances, where it breaks down the proteins into polypeptides, and this is due to its inability to break the peptide bonds that are present among the amino acids.

---

28 **(a) The role of pH in :**

- Mouth (weak alkaline medium pH = 7.4) stimulates the amylase "ptyalin" enzyme to hydrolyze the starch into disaccharide which is maltose.

- Stomach (acidic medium pH = 1.5 : 2.5) activates the pepsinogen enzyme (inactive form) into pepsin enzyme (active form) that digests the proteins into short chains of polypeptides.
- Duodenum (alkaline medium pH = 8) stimulates the activity of the pancreatic juice that contains pancreatic amylase enzyme, trypsinogen enzyme and lipase enzyme.

(b) Protein is digested in the stomach at (pH = 1.5 : 2.5) and in the duodenum at (pH = 8).

---

29 **(a)** 1. (6) Stomach / (7) Pancreas / (8) Ileum.
2. (3) Liver.
3. (2) Salivary glands / (7) Pancreas.
4. (1) Mouth / (5) Duodenum / (8) Small intestine.

(b) *Answer by yourself.*

---

30 **(a)** (X) ⟶ Maltase enzyme.
(A) ⟶ Maltose sugar.

(b) Enzyme (X) "maltase" is secreted from special cells in the wall of the small intestine / Molecule (A) "maltose sugar" is formed in :
- Mouth : as a result of the hydrolysis of starch by the amylase (ptyalin) enzyme.
- Duodenum : as a result of the hydrolysis of starch and glycogen by the pancreatic amylase enzyme.

---

31 *Answer by yourself.*

---

32 **(a)** (A) : starch. (B) : maltose.
(C) : fructose. (D) : lactose.
(E) : amylase enzyme.
(F) : maltase enzyme.
(G) : sucrase enzyme.
(H) : lactase enzyme.

(b) Glucose will not be formed / Because amylase enzyme (E) catalyzes the hydrolysis of starch (A) into maltose sugar (B), where maltose will be digested into a simpler form that is glucose by the action of maltase enzyme (F).

(c) (E) : salivary glands and pancreas.
(F), (G) and (H) : special cells in the wall of the small intestine.

---

33 (1) Lipids (Fats). (2) Liver.
(3) Proteins. (4) Pepsin.
(5) Starch. (6) Amylase (Ptyalin).
(7) Maltose sugar.

---

34 As the intestinal juice that is secreted from special cells in the wall of the small intestine contains a group of digestive enzymes for disaccharides that are resulted from the digestion of carbohydrates to convert them into monosaccharides that are absorbed by the villi to pass through the blood route.

---

35 **The statement is correct** / As eating carbohydrates stimulates the activity of digestive enzymes of carbohydrates, such as the amylase (ptyalin) and pancreatic amylase enzymes, and also the digestive enzymes of disaccharides, while eating proteins stimulates the activity of pepsin and trypsin enzymes, as well as the peptidases enzymes, but eating fats stimulates the activity of bile juice and lipase enzyme.

---

36 To absorb some of the finely emulsified fats that are not hydrolyzed by the enzymes through the engulfment process.

---

37 **(a)** (1) Bile juice. (2) Emulsified fats.
(3) Lipase enzyme. (4) Glycerol.
(5) Villi. (6) Lacteal vessel.

(b) *Answer by yourself.*

---

38 **(a)** The blood capillaries transport amino acids, and the lacteal vessels transport fatty acids.

(b) Structure no. (5) "vein" / Because it carries the blood from blood capillaries carrying glucose in the hepatic portal vein to the liver, then from it to the inferior vena cava and finally to the heart.

(c) Structure no. (1) "lymphatic vessel".

(d) The absorption of digested food, in addition to the engulfment of the fat globules that are not hydrolyzed by the enzymes through the engulfment process.

(e)

P.O.C.	Structure no. (1) "Lymphatic vessel"	Structure no. (5) "Vein"
Absorbed substances that pass through it :	Glycerol, fatty acids and fat soluble vitamins which are A, D, E and K vitamins.	Water, mineral salts, monosaccharides, amino acids and water soluble vitamins.
Path of the absorbed substances :	Lacteal vessels inside the villi ↓ Lymphatic system ↓ Superior vena cava ↓ Heart	Blood capillaries in the villi ↓ Hepatic portal vein ↓ Liver ↓ Hepatic vein ↓ Inferior vena cava ↓ Heart

39 As the absorption process of digestion products consumes energy to force these products to diffuse against the concentration gradient through the blood and lymph.

40 **The statement is correct** / As the inferior vena cava carries water, mineral salts, monosaccharides, amino acids and water soluble vitamins.

41 *Answer by yourself.*

42 **The statement is wrong** / As the epithelial layer cells of villi participate in the absorption process and not in the digestion process, where they don't secrete any digestive enzymes, but they absorb the fat globules that are not hydrolyzed by the enzymes through the engulfment process.

43 Because these vitamins (A, D, E and K) are soluble in the fatty acids, while vitamin (B) is soluble in water.

44 **(a) If the meat piece (protein) :**

- **Is deviod of fats :**
  - The meat protein will be digested into short polypeptide chains by the pepsin enzyme that is secreted from the stomach and by the trypsin enzyme that is secreted from the pancreas in the duodenum.
  - The peptide bonds in the polypeptide chains will be broken, producing different amino acids by the peptidases enzymes that are secreted from the special cells in the wall of small intestine.
- **Contains fats :**
  - The fats will change into emulsified fats by the bile juice that is secreted from the liver and is poured in the duodenum.
  - The emulsified fats will change into fatty acids and glycerol by the lipase enzyme that is secreted from the pancreas in the duodenum, besides the digestion of proteins as mentioned before.

(b) *Answer by yourself.*

45 (a)

Food substance	First place of digestion	Juice which digests it
Bean	Stomach	Gastric juice
Oil	Duodenum	Bile juice
Bread	Mouth	Saliva

(b)

Food substance	The final form of digestion
Bean	Amino acids
Oil	Fatty acids + Glycerol
Bread	Monosaccharides (Glucose)

(c) The glucose sugar transfers from the blood capillaries inside the villus to the hepatic portal vein, then to the liver and from it to the hepatic vein to pour its contents into the inferior vena cava, then to the heart.

46 **The statement is wrong** / As some of the fatty acids and glycerol recombine again to form fats, and these fats pass to the lacteal vessels inside the villi, then to the lymphatic system which carries them slowly and pour them into the superior vena cava, then to the heart.



47 As the stomach digests the protein substances only, while inside the small intestine the digestion of all food substances in the duodenum is completed, then the absorption of digested food in the ileum (by villi) and transporting it to the blood or lymph to be distributed to all the body cells.

---

48 The animal will die, as its body will not make benefit from the digested food substances, due to its inability to absorb them and transfer them to the blood.

---

49 The liver will not be able to convert the monosaccharides that are resulted from the carbohydrates digestion into glycogen that is stored in the liver to be used by the body again after its oxidation to produce energy that is required for performing the body vital functions, leading to their stop and the death of the living organism.

---

50 The body will lose (excrete) a high percentage of mineral salts and water with the faeces. So, they will lose their semi-solid shape.

---

51 **The statement is correct /** As the absorption process that takes place in the small intestine occurs to the digested food substances and passes them to the blood or lymph, while the absorption process that takes place in the large intestine occurs to water and some salts from the wastes of undigested food, this is occurred through many convolutions found in its lining.

Answers of questions that measure high levels of thinking

1 **(1)** ⓒ Mouth / Stomach / Small intestine.

(2) ⓐ HCl acid.

As enzyme (C) represents enterokinase enzyme which isn't from the digestive enzymes, but it activates only the trypsinogen enzyme in the small intestine (3) at (pH = 8), while enzyme (A) represents salivary amylase enzyme that is secreted from the salivary glands in the mouth (1) at (pH = 7.4), which stops its action in stomach (2) as a result of secreting HCl acid to convert the stomach medium into acidic medium (pH = 2) and activates enzyme (B) which is pepsinogen.

---

2 ⓑ protein

As the milk is the only source of protein for infants which contains casein, and if it was not coagulated, it would leave the stomach without digestion. So, it must be present in stomach for a period of time for the digestion of proteins.

---

3 ⓒ (2) + (4) + (6) / (3) + (4) + (5)

- By using the first solution, the protein (egg white) is hydrolyzed into short polypeptide chains by the action of pepsin enzyme (2) in the presence of water (4) and acidic medium (i.e. in the presence of HCl acid (6) "pH = 1.5 : 2.5").
- By using the second solution, the protein (egg white) is hydrolyzed into polypeptides by the action of trypsin enzyme (3) in the presence of water (4) and alkaline medium (i.e. in the presence of sodium bicarbonate (5) "pH = 8").

---

4 ⓑ Not digested / Digested by a lower rate than the normal rate / Digested by a normal rate

As the digestion of proteins doesn't occur, due to the absence of enterokinase enzyme (that is secreted from the inner wall of the small intestine) from the pancreatic juice, where it converts the inactive trypsinogen enzyme into active trypsin to affect the protein, the fats are digested by a lower rate than the normal rate, due to the absence of the bile juice that is secreted from liver, where it acts on the conversion of fats into emulsified fats, which facilitates and accelerates the effect of lipase enzyme, and starch is digested by a normal rate, due to the presence of pancreatic amylase enzyme that hydrolyzes the starch into disaccharide sugar (maltose).

5 ⓐ It changes in test tube (1) faster than test tube (2).

As the mixture shape is changed in test tube (1) faster than test tube (2), due to the addition of bile juice that acts on the conversion of fats (oil) into emulsified fats (i.e. dividing the large masses of fats into small fat globules) to facilitate and accelerate the effect of lipase enzyme on fats and convert them into fatty acids and glycerol.

---

6 ⓓ Disturbance in HCl acid secretion.

As the disturbance in the pancreas or in the action of lipase enzyme or in the secretion of bile juice is accompanied by the indigestion of fats, then they pass in the large intestine without digestion to be expelled out with wastes, but the disturbance in the secretion of HCl doesn't affect the digestion of fats, but affects the digestion of proteins.

---

7 ⓒ Trypsin.

As enterokinase enzyme activates trypsinogen into trypsin (product) which is an enzyme having the ability of specific activation, where it acts on the hydrolysis of proteins into polypeptides.

Answers of Test on Chapter 1

1 ⓓ It is heterotrophic plant which doesn't contain chlorophyll (A) or (B).

2 ⓑ Peptidases enzymes / Amino acids.

3 ⓑ active transport

4 ⓒ the light intensity is very low.

5 ⓓ Pancreas.

6 ⓓ Deficiency in the formed amount of glucose from photosynthesis.

7 ⓐ Enterokinase.

8 ⓑ 0 / 17 / 6

9 ⓑ Fats.

10 ⓒ Stomach.

11 ⓓ PGAL containing ^{18}O

12 ⓓ Peptidase.

13 ⓒ Active transport process decreases.

14 ⓓ CO_2 reduction.

15 ⓒ

16 ⓓ Desert plants and salty water environment plants.

17 ⓐ Enzymes.

18 ⓓ Peanuts and sesame.

19 ⓐ Increases / Increases

20 ⓓ D and E

---

21 : 23 *Answer by yourself.*



Answers of Chapter 2 Lesson One

First Answers of Multiple Choice Questions

1 ⓒ *Spirogyra* – Bean – Hawk.

2 ⓓ The innermost row of cells in cortex.

3 ⓒ Xylem transports water and salts, while phloem transports the ready-made sap.

4 ⓓ Barrel-shaped cells that have a storage function.

5 ⓐ Xylem tissue.

6 ⓓ Vascular bundles that are arranged in a cylinder.

7 (1) ⓐ Vessels and tracheids.
(2) ⓑ Transporting water.
(3) ⓓ In the stages of their formation.

8 ⓒ Cambium tissue.

9 (1) ⓑ Sieve tube.
(2) ⓒ Xylem vessel.

10 (1) ⓐ (1).
(2) ⓑ (2).

11 ⓑ Each of them is arisen from the same type of cells.

12 (1) ⓓ (1) and (4).
(2) ⓒ (2) and (3).

13 ⓓ Formation of specialized vascular tissues.

14 ⓒ Cambium.
As the vascular bundle in the stem consists of phloem, cambium and xylem, while the vascular bundle in the leaf consists of xylem vessels and phloem only, as the epidermal cells are present in both the plant stem and its leaves.

15 ⓓ Companion cells.
As tracheids, xylem vessels and sieve tubes are devoid of nuclei, but they are present in the companion cells, and make them able to divide.

16 (1) ⓓ The tissue will change into xylem tissue.
(2) ⓑ cytoplasm.
(3) ⓐ ATP

17 ⓑ pulling

18 ⓓ Water evaporation from the mesophyll tissue cells.

19 ⓒ Pectin and lignin.

20 ⓑ Planting its roots directly in a moist soil.

21 ⓓ It is a permeable substance to water and solutes.

22 ⓓ Root / Stem / Leaf

23 ⓓ

24 ⓐ The adhesion force among water molecules.

25 ⓑ The presence of cohesion force.

26 ⓑ

27 ⓑ Fatty acids.

28 ⓒ Increasing both the temperature and the concentration of oxygen.

29 ⓑ The absorbed heat from the Sun.
As the water ascent in the plant stem is affected by the pulling forces that originated from the transpiration, which is affected by the heat absorbed from the Sun.

Second Answers of Miscellaneous Questions

1 The statement is wrong / Because the *Spirogyra* alga belongs to the aquatic algae that don't need the presence of specialized transport tissues, where the raw materials transfer with the products of photosynthesis process from one cell to another by diffusion and active transport.

2 Vessels and tracheids in the xylem tissue.

3 (a)

The structure	The importance
No. (2) "Cytoplasmic threads":	Transferring the high-energy organic food substances from a sieve tube to another through the pores of sieve plates, till reaching all the plant parts.
No. (4) "Companion cell" :	Regulating the vital processes of sieve tubes and supplying them with energy in the form of ATP molecules, as it contains a large number of ribosomes and mitochondria.

(b) The transport of energy carrier compounds (ATP molecules) that are formed abundantly in part no. (4) "companion cell" to part no. (1)

"sieve tubes", where plasmodesmata connects the cytoplasm of the sieve tube with the cytoplasm of the companion cell.

(c) Structure no. (4) "companion cell" will die, therefore it will not be able to regulate the vital processes of structure no. (1) "sieve tubes", leading to the stop of the ready-made sap transportation to all the plant parts. So, the plant will die.

---

4 Because decreasing the temperature or the shortage of oxygen in the cells slows down the movement of cytoplasm and its streaming in the sieve tubes.

---

5 As the phloem of leaves is connected with the phloem of the stem and roots, so that a connected network of transporting vessels is formed in all the plant parts, therefore the roots obtain their food after the performance of photosynthesis process and formation of high-energy organic compounds inside the plant leaves.

---

6 As the xylem tissue contains xylem parenchyma which is represented by rows of living parenchyma cells (contain nuclei) that are present among the xylem vessels.

---

7 **(a)** Because the lining of structure no. (1) "xylem vessels" contains strands of lignin that work on the non-collapsing of its wall inward.

(b) Structure no. (1) "xylem vessels" / Because structure no. (1) consists of a series of elongated cylindrical cells that are joined end to end, therefore it is opened from the two ends, while structure no. (2) "tracheids" each of them consists of one cell with tapered ends. So, structure no. (1) has a greater role than structure no. (2) in transporting water and salts inside the plant.

(c) Structure no. (1) is characterized by several characteristics, such as :

1. The walls of xylem vessels consist of cellulose and lignin that have a colloidal nature which is able to imbibe water, which explains the water transport by imbibition.
2. The diameter of xylem vessels ranges between 0.2 : 0.5 mm, which explains the water movement by the capillarity phenomenon.
3. The adhesion force between water molecules and the walls of xylem vessels that keeps the water columns held continuously against gravity, which explains the water movement by the cohesion - adhesion and transpiration pull forces.

(d) Water will not pass from inside the xylem vessel to its outside.

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8 **The functional suitability of :**

(a) Xylem vessels :

- They consist of a series of elongated cylindrical cells that are joined end to end and have opened ends, in order to allow the movement of water and salts from the root to the leaves for performing the photosynthesis process.
- Their walls consist of cellulose and lignin with a colloidal nature that has the ability to imbibe water, as well as lignin is impermeable to water and solutes.
- Their walls contain many pits that allow the passage of water from inside the vessel to its outside.
- Their lining contains strands of lignin in different shapes, such as spiral and annular, to support the vessel and prevent the inward collapse of its wall, working on the plant support.

(b) Tracheids :

They are similar to xylem vessels, but each tracheid consists of one cell with tapered end, and it is pitted more than the vessels, as well as the passage of water and salts through them is less than their passage in the xylem vessels.

(c) Phloem :

- Sieve tubes :
  - Elongated cells contain cytoplasmic threads, acting on transporting the ready-made food substances (sap) from the leaf to all the plant parts.
  - They are separated from each other by perforated cross-walls "sieve plates" to allow the passage of cytoplasmic threads through them.

- Companion cells :
  Living cells, where each of them accompanies a sieve tube, they contain a large number of ribosomes and mitochondria to be able to organize the vital processes of sieve tubes and supply them with the energy needed for the transport process in the form of ATP molecules.

9 *Answer by yourself.*

10 (a) • **The function of structure no. (3) "collenchyma cells" :**
- Have a supporting function.
- Perform photosynthesis process, if they contain chloroplasts.

• **The function of structure no. (5) "starch sheath" :** storage of starch granules.

(b) Parenchyma tissue is present in :
- Epidermis layer "structure no. (2)".
- Parenchyma cells in the cortex layer "structure no. (4)".
- Pericycle "structure no. (6)".
- Phloem parenchyma "structure no. (7)".
- Xylem parenchyma "structure no. (10)".
- Medullary rays "structure no. (11)".
- Pith "structure no. (13)".

11 As the cotton plant is considered a dicot plant and its stem contains :
- Collenchyma cells in the cortex layer that have a supporting function.
- Pericycle tissue in the vascular cylinder region which consists of parenchyma cells alternate with groups of fibrous cells, acting on strengthening the stem and making it erect.
- Xylem tissue, where the lining of its vessels and tracheids contains lignin which supports the stem.

12 (a) The curve (AB) illustrates an inversely relationship between the diameter of xylem vessels and the height of water inside them, as when the diameter of xylem vessel decreases, the height of water inside it increases by the capillarity phenomenon.

(b) Because the maximum height of water in the finest tube never exceeds 150 cm (1.5 m).

(c) Water will not rise in the xylem vessel by the capillarity phenomenon.

13 Because the hydrogen bonds work on the cohesion of water molecules with each other strongly inside the xylem vessels and tracheids, which keep the presence of water column inside the xylem vessels connected (continuous).

14 Because the walls of xylem vessels consist of cellulose and lignin with a colloidal nature that has the ability to imbibe water, helping in the adhesion force between water molecules and the walls of xylem vessels, therefore it works on the presence of water columns held continuously.

15 **The statement is wrong /** As water transfers from the root to the leaves, according to the following arrangement : root hair - cortex - xylem - mesophyll tissue - stomata.

16 *Answer by yourself.*

17 (a) • Cohesion force among the water molecules with each other inside the xylem vessels and tracheids.
- Adhesion force between water molecules and walls of xylem vessels.
- Transpiration pull forces that result from the continuous transpiration in the leaves.

(b) *Answer by yourself.*

(c) The water comes out from the stump (exudation phenomenon), and this occurs by the action of a pressure or force from the root due to the absorption of water by osmosis phenomenon "root pressure".

18 (a) Air chambers above stomata in the leaf.

(b) *Answer by yourself.*

(c) The high-energy organic compounds (carbohydrates, proteins and fats).

19 **Transpiration process /** As plant physiologists had proved that the cohesion, adhesion and transpiration pull forces are the main forces that

work on pulling water in the stem for high and long distances reaching about 100 m, while the maximum level of water in the finest xylem tubes doesn't exceed 150 cm under the effect of capillarity phenomenon.

20 **The statement is correct** / As the two scientists Thain and Canny could see long cytoplasmic threads carrying organic substances inside the sieve tube and extending from a tube to another through the pores of sieve plates, and this is called by "cytoplasmic streaming".

21 The cytoplasmic streaming movement through the sieve tubes needs energy, where the transport process in phloem is active process which needs energy carrier compounds (ATP molecules) that are formed abundantly in the companion cells and transfer from them by the plasmodesmata that connects the cytoplasm of companion cell with the cytoplasm of sieve tube.

22 *Answer by yourself.*

23 As the transport process of water and salts through the xylem vessels is affected by :

- The root pressure which is affected rapidly by the external factors.
- The transpiration pull force that is affected by external factors, such as temperature, humidity and light.

As well as the transport process of organic substances in the phloem is affected by external factors, such as temperature and oxygen.

Answers of questions that measure high levels of thinking

1 ⓓ A transverse section in the stem.

As when a transverse section was made at the stem of the two plants, then examining the vascular bundles structure in the stem by the light microscope, we found that the older plant vascular bundle contains a secondary phloem outward and secondary xylem inward more than the younger plant. So, the cross-sectional area in the older plant is larger than that in the younger plant.

2 ⓐ Companion cells / Cytoplasm / Sieve tubes / Absence of nucleus / Xylem vessels

As the companion cells (a) share the sieve tubes (c) in the presence of the cytoplasm (b) in each of them, and the xylem vessels (e) share the sieve tubes (c) in the absence of the nucleus (d) in each of them.

3 ⓓ Amino acids and sugar will not be transported to the roots.

As the cut ring represents the phloem which is the tissue that is responsible for transporting the organic substances to all the plant parts, therefore the amino acids and sugar won't be transported downward to the roots.

4 ⓒ (3).

As the transpiration process takes place during the day with a higher rate, which is one of the forces affecting the sap (water and salts) ascent in the plant.

5 ⓑ In phloem only.

As the plant will use the radioactive isotope (^3H) that is present in water during the photosynthesis process that takes place in the leaves, where CO_2 gas is fixed to form the high-energy carbohydrates that are transferred to all the plant parts through the phloem tissue only.

Answers of Chapter 2 Lesson Two

First Answers of Multiple Choice Questions

1 ⓓ Atrio-ventricular node ⟶ His fibers ⟶ Purkinje fibers ⟶ Wall of ventricles.

2 ⓒ (3).

3 ⓒ

4 ⓑ They are present at the connection of the heart with the superior and inferior venae cavae.

5 ⓒ They contain valves.

6 ⓓ (2) & (3) only.

7 ⓐ Deoxygenated / Thick / Small



8 ⓒ It carries blood under high pressure.

9 ⓒ Vein – Blood capillary – Artery.

10 ⓓ Their wall contains tiny pores.

11 ⓐ (1).

12 ⓑ blood with high pressure.

13 ⓒ (Z).

14 ⓑ Aorta – Pulmonary vein – Renal artery.

15 ⓓ The contraction of the lower side of heart is delayed than that of the upper side.
As the contraction impulse arrives from the sino-atrial node to the two atria muscles directly (the upper side of heart). So, it contracts first, then the contraction impulse reaches the atrio-ventricular node then to the two ventricles muscles (the lower side of heart) through His fibers, and spread from the inter-ventricular septum to the wall of both ventricles through Purkinje fibers. So, the contraction of the lower side of heart is delayed than that of the upper side.

16 ⓑ (1) & (3).
As vessels no. (3) "venae cavae" carry deoxygenated blood from the body parts to enter the heart which pumps it through vessel no. (1) "pulmonary artery" to the two lungs, as the process of gas exchange takes place.

17 **(1)** ⓓ It carries oxygenated blood.
As the direction of the blood in this vessel is upward in the arm to reach the heart, which represents a non-pulsating vein that contains valves and carries deoxygenated blood.

(2) ⓑ The thickness of its wali is lower than no. (1).
As the direction of the blood in this vessel is downward in the arm away from the heart, which represents an artery whose wall thickness is bigger than that of vein (1) and carries oxygenated blood under high blood pressure.

18 ⓑ Glucose / Oxygen / Carbon dioxide.
As the cell gets its need from glucose (X) that is found in the blood plasma, and from oxygen (Y) that found in the red blood cells haemoglobin (oxyhaemoglobin), while carbon dioxide (Z) comes out to bind with the haemoglobin (carbo-aminohaemoglobin).

19 ⓒ (2) & (3).
As vessels no. (2) carry oxygenated blood which comes from the blood capillaries of the two lungs (pulmonary veins), while vessels no. (3) carry deoxygenated blood that comes from the different body parts (venae cavae) that carry blood at low pressures.

20 ⓐ Glucose, hormones and urea.

21 ⓓ Two lungs.

22 ⓐ Red blood corpuscles.

23 ⓑ The blood liquidity (haemophilia).

24 ⓐ

25 ⓑ The rate of coagulation occurrence when exposed to bleeding.

26 ⓓ Fibrinogen.

27 ⓒ vitamin (K).

28 ⓓ Because they slow down the movement of blood in normal manner.

29 ⓓ Breaking down of blood platelets inside the blood vessel.

30 ⓒ Prothrombin and heparin.

31 ⓐ Transferring oxygen.

32 ⓓ Fibrin.

33 ⓑ Arteries of the right arm.

34 ⓑ The number of WBCs.

35 ⓒ Plasma / Red and white blood corpuscles and blood platelets
As the red and white blood corpuscles and blood platelets are high dense components. So, they settle down in the tube due to the centrifugation process, while the plasma is a low dense fluid. So, it floats on the surface.

36 ⓒ The two statements are correct.
As the blood in its normal state contains various group of soluble proteins in plasma, such as : albumin, globulin and fibrinogen. While in case of abnormal state of blood (blood clot) it contains an insoluble protein called fibrin.

37 ⓐ The increase in the number of RBCs.
As when the distance from the sea level increases, the percentage of oxygen decreases in the atmospheric air, which leads to increasing the number of RBCs to transfer the highest amount of oxygen required for the body.

38 ⓒ White blood corpuscles.
As the white blood corpuscles attack the microbes. So, their number increases in the presence of an inflammation.

39 ⓒ suffers from anemia.
As the percentage of plasma that found in the blood is more than 54%, which means a decrease in the number of the red blood corpuscles, therefore a decrease in the haemoglobin level in blood which leads to the occurrence of anemia.

40 ⓒ 2.9 L
∵ The percentage of plasma that found in blood is 54%
∴ The amount of plasma that found in blood $= \frac{6 \times 54}{100} = 3.24$ liters
∵ Water represents 90% of the plasma volume.
∴ The amount of water that found in blood $= \frac{90 \times 3.24}{100} = 2.9$ liters

Second Answers of Miscellaneous Questions

1 • **Mesentery membrane :** it is a membrane that joins the folds of the small intestine in the digestive system.
• **Pericardium membrane :** it is a sac-like membrane that surrounds the heart and works on its protection and facilitating its movement.

2 **The statement is correct** / As the heart valves allow the blood to pass in one direction only.

3 A disturbance in the blood circulation happens due to the returning back of blood to the two atria when they relax due to the absence of valves with flaps and the blood returns back to the two ventricles when they relax due to the absence of semi-lunar valves.

4 *Answer by yourself.*

5 **(a)** (A) : aortic valve "semi-lunar valve".
(B) : left bicuspid "mitral" valve.
(C) : right tricuspid valve.
(D) : pulmonary valve "semi-lunar valve".
(b) (1) : oxygenated blood / under low pressure.
(2) : oxygenated blood / under high pressure.
(3) : deoxygenated blood / under high pressure.
(4) : deoxygenated blood / under low pressure.

(c)

Structure no. (6) "Right ventricle"	Structure no. (7) "Left ventricle"
• It carries deoxygenated blood. • Its wall is less thick. • It is separated from the right atrium by a tricuspid valve.	• It carries oxygenated blood. • Its wall is more thick. • It is separated from the left atrium by a bicuspid valve.

(d) By changing the physical or psychological states, where structure no. (5) "sino-atrial node" is connected with a nerve "sympathetic" that increases the rate of heartbeats gradually after waking up, in states of joy and when performing a vigorous physical effort.

6 The heartbeats can be differentiated into two sounds, as follows :
• Long and low-pitched (Lubb) sound, as a result of the closure of two valves between the atria and ventricles, during the ventricular contraction.
• Short and high-pitched (Dupp) sound, as a result of the closure of the aortic and pulmonary valves, during the ventricular relaxation.

7 To protect them from any damage, as even a minor damage in the arteries may result in the loss of a great amount of blood, due to the high blood pressure in the arteries which is higher than the veins.

8 To bear the blood pressure, as the artery carries blood from the heart to all the body parts during the contraction of two ventricles, while the vein carries blood from the different body cells to the heart.

9 **(a)** • Vein.
• **The reasons :**
1. The blood is directed upward (in the direction of the heart).
2. The presence of valves in it.
(b) When the two muscles contract, the blood is pushed upward and the valves prevent its backflow in the opposite direction.



(c) The contraction of the two muscles leads to an increase in the rate of heartbeats, where the change in the physical state "performing effort" is followed by an increase in the number of heartbeats by the action of the sympathetic nerve that is connected with the sino-atrial node which is considered the pacemaker of the heartbeats.

(d) • The presence of valves inside the vein.
• The muscles that surround the vein.

10 Because of the increased blood pressure in it more than that in the vein, therefore it is difficult to be healed after injury, as losing a large amount of blood may expose the body for a shock that may be followed by death.

11 (a) (X) : artery , (Y) : vein.
(b) • The inner layer of vessel (X).
• Their presence is rare in vessel (Y).

12 Due to the presence of valves in some veins that allow the passage of blood in the direction of the heart and prevent its backflow, such as the veins that are present in limbs which are near to the skin surface and the presence of the muscles that surround these veins.

13

Pulmonary vein	Pulmonary artery
• It carries oxygenated blood.	• It carries deoxygenated blood.
• The oxygenated blood inside it moves from the two lungs to the left atrium of the heart.	• The deoxygenated blood moves from the right ventricle of the heart to the two lungs.
• Its wall is less thick.	• Its wall is more thick.
• Not pulsated.	• Pulsated.
• It carries blood under low pressure.	• It carries blood under high pressure.

14 The blood will return back in the veins and will not be directed towards the heart, because the valves always work on the passage of the blood in one direction, so that a disturbance in the blood circulation will occur.

15 (a) • The walls of structure no. (2) "blood capillaries" are thin and the presence of tiny pores among their cells help in the rapid exchange of substances between the blood and tissues' cells.
• Structure no. (2) "blood capillaries" spread in the spaces among the cells of all the body tissues to supply them with their requirements of food and oxygen.

(b) It spreads in the spaces among the cells of all the body tissues.

(c) 1. Structure no. (1) "artery".
2. Structure no. (3) "vein".

(d) 10 mm Hg.

16 **The statement is correct /** As some veins contain valves that allow the passage of blood in the direction of heart and prevent its backflow, such as the veins that are present in limbs and near to the skin surface.

17 Each of them has thin wall.

18 The individual will suffer from anemia which is accompanied by a decrease in the haemoglobin efficiency in transporting oxygen from the two lungs to all the body parts, and transporting carbon dioxide from all the body parts to the two lungs.

19 The percentage of haemoglobin in red blood corpuscles will decrease below the normal percentage (level), as haemoglobin consists of protein and iron, leading to the suffering of the person from anemia.

20 As the prothrombin (protein secreted by the liver with the help of vitamin (K) and poured in the blood) has a role in the formation of blood clot, where it is converted into thrombin in the presence of thromboplastin, calcium ions and clotting factors in the blood, while fibrinogen (soluble protein in the blood plasma) is converted into fibrin (insoluble protein) in the presence of thrombin enzyme.

21 The liver secretes prothrombin protein by the help of vitamin (K) and pours it in the blood to be converted into thrombin that has an important role in the formation of blood clot, when the blood vessel is cut or teared.

22 Oxygen gas (O_2).

23 *Answer by yourself.*

24 As fibrin protein is insoluble in blood plasma, it precipitates in the form of a network of microscopic interlacing fibers in which the blood cells are aggregated, forming a clot which blocks the cut in the damaged blood vessel to stop the bleeding.

25 The liver secretes the prothrombin protein by the help of vitamin (K) and pours it in the blood, then it is converted into thrombin in the presence of thromboplastin, calcium ions and clotting factors, then it stimulates the conversion process of fibrinogen into fibrin, therefore the blood clot is formed.

26 (a) *Answer by yourself.*

(b) 1. Protecting blood from bleeding that may lead to death.

2. Protecting the body from the invasion of microbes and pathogens in the site of injury or the cut blood vessel.

(c) Thrombin enzyme / It stimulates the conversion process of fibrinogen into fibrin, forming the blood clot that blocks the hole of the cut blood vessel to stop the bleeding.

27 As the occurrence of bleeding leads to the loss of large amount of blood, leading to a decrease in the blood level in the body, therefore the blood pressure decreases.

28 Figure no. (2) represents the systolic blood pressure, and figure no. (1) represents the diastolic blood pressure / Because the level of mercury column is higher in figure no. (2) which represents the maximum blood pressure "systolic".

29 The statement is wrong / The maximum blood pressure is in the arteries that are present close to the heart, where the ventricles contraction (heart beating) leads to increasing the blood pressure.

30 It means that the number 110 mm Hg indicates the blood pressure when the two ventricles contract, while the number 70 mm Hg indicates the blood pressure when the two ventricles relax.

31 (a) • Figure (X) represents the maximum value of blood pressure.

• Figure (Y) represents the minimum value of blood pressure.

(b) The sound in (X) is long and low-pitched (Lubb), while the sound in (Y) is short and high-pitched (Dupp).

Answers of questions that measure high levels of thinking

1 ⓐ From foot to heart.
As the blood vessel contains a valve which is a vein carrying deoxygenated blood, whose final branches pour at the inferior vena cava which pours at the heart. While the blood that passes through the hepatic portal vein, its passage is from the intestine to the liver not vice versa, as well the blood that reaches the kidney and the two lungs is through the arteries which are devoid of valves.

2 ⓒ Amino acids.
As when the blood passes through the blood capillary to be poured at the end in the hepatic portal vein, the absorption of amino acids from the villi that are present in the wall of the small intestine will be continued. So, their concentration increases at point (Y) than that at point (X). While starch is a complex substance that can't be absorbed, urea is an excretory substance and the concentration of oxygen decreases with continuing its passage in the blood capillary.

3 ⓐ the artery and mixing with heparin substance.
As the artery contains the red blood corpuscles that carry the oxygenated blood and to avoid the measuring mistakes, the sample is mixed with heparin substance to avoid the blood coagulation.

4 ⓒ The two statements are correct.
As the liver secretes :
• The prothrombin protein by the help of vitamin (K) to be poured in blood, then changed into thrombin in the presence of thromboplastin, calcium ions and clotting factors, then thrombin stimulates the process of converting



fibrinogen into fibrin. So, the blood clot is formed.

- The heparin substance which prevents the conversion of prothrombin into thrombin, therefore the blood isn't coagulated inside the blood vessels in its normal state.

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5 (1) ⓑ (2).
As food substance no. (2) contains the highest amount of iron that enters in the formation of the haemoglobin substance of the red blood cells which transports oxygen from the two lungs to all the body cells through the blood circulation.

(2) ⓐ (4).
As food substance no. (4) contains the highest amount of calcium which is needed for the conversion of the prothrombin substance into thrombin, which is one of the steps of the blood clot formation in the regions that exposed to wounds.

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6 ⓓ (D).
As direction (D) represents oxygenated blood comes from the heart to arteries, arterioles, then to this blood capillary. So, the pressure is higher at it than the other points, then the gases exchange process occurs with the cells to make the deoxygenated blood reach point (A) under a slightly low pressure to pass through the venules, veins, then to one of the venae cavae.

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7 ⓑ
As the heartbeats rate (number of heartbeats) increases gradually after waking up till reaches its normal rate.

Answers of Chapter 2 Lesson Three

First Answers of Multiple Choice Questions

1 ⓒ left ventricle.

2 ⓑ Aortic valve.

3 ⓐ The pressure of aorta increases.

4 ⓐ 1

5 ⓓ The two ventricles are filled with blood at the same time.

6 ⓑ Opening of atrio-ventricular valves.

7 ⓑ Two times.

8 ⓑ Pulmonary artery.

9 ⓒ Aorta.

10 ⓒ The opening of semi-lunar valve and the closure of tricuspid valve.

11 ⓐ (1) & (2).

12 (1) ⓒ Transporting the deoxygenated blood from the heart to the two lungs.
(2) ⓓ Inferior vena cava.

13 ⓑ (X) ⟶ (Z) ⟶ (Y) ⟶ (L).

14 ⓒ

15 ⓐ Superior vena cava / Aorta.

16 (1) ⓐ Glucose.
(2) ⓑ carbo-aminohaemoglobin.
(3) ⓒ The upper part of inferior vena cava.

17 ⓒ (6) ⟶ (7) ⟶ (8) ⟶ (5).

18 ⓒ Hepatic portal vein.

19 ⓒ (W) ⟶ (X) ⟶ (Z) ⟶ (Y).

20 ⓒ The two statements are correct.

21 ⓒ Bone marrow.

22 ⓑ

23 ⓐ 2

24 ⓓ Oxygen / Carbon dioxide

25 ⓐ Calcium ions.

26 ⓓ (1), (2), (3) and (4).

27 ⓐ ✓ / ✓ / ✓

28 ⓒ 3

29 ⓓ Two atria / Right ventricle / Left ventricle.
As the thickness of the heart chamber depends on the distance where the blood is pumped to, because the left ventricle pushes the blood from the heart to all the body parts (long distance). So, it will be the thickest, whereas the right ventricle pushes the blood from the heart to the two lungs (shorter distance). So, it will be less thick than the left ventricle, while the two atria push the blood to the corresponding ventricles only. So, they will be the thinner.

30 ⓒ Vena cava.
As the veins carry deoxygenated blood (contain the highest level of carbon dioxide) and under low pressure than the arteries.

31 ⓑ Pulmonary and aortic valves.
As the two ventricles contract at the same time. So, the pulmonary valve opens to permit the deoxygenated blood passage to the pulmonary artery and the aortic valve opens to permit the passage of the oxygenated blood to the aorta, while the rest choices include the opening of one of the valves that is synchronized with the

closure of the other valve and vice versa on the contraction and relaxation of the heart chambers.

32 ⓑ Mitral and aortic valves.
As the mitral (bicuspid) valve permits the passage of the oxygenated blood that comes from the two lungs through the pulmonary veins to the left atrium to enter to the left ventricle during the contraction of the left atrium, as well the aortic valve permits the passage of the oxygenated blood to pass from the left ventricle to the aorta during the contraction of the left ventricle.

Second Answers of Miscellaneous Questions

1 As aorta transfers the oxygenated blood from heart to all the body parts (i.e. long distance). So, it needs higher blood pressure, while the pulmonary artery pushes the deoxygenated blood from heart to the two lungs (i.e. short distance), so that it needs lower blood pressure.

2

Bicuspid valve	Tricuspid valve
• Lies between the left atrium and left ventricle. • Allows the passage of blood from the left atrium to the left ventricle in one direction and prevents its return back to the left atrium again.	• Lies between the right atrium and right ventricle. • Allows the passage of blood from the right atrium to the right ventricle in one direction and prevents its return back to the right atrium again.

3 As the digested food (glucose and amino acids) that is absorbed from the small intestine passes first to the liver, in order to filter some food substances that exceed the body needs, therefore some changes occur inside the liver, where the monosaccharides, such as glucose are converted into polysaccharides stored in the form of glycogen.

4 Blood capillaries in villi ⟶ Hepatic portal vein ⟶ Liver ⟶ Hepatic vein ⟶ Inferior vena cava ⟶ Right atrium of the heart

5 (a) Some changes occur to them in the liver, where the monosaccharides, such as glucose are converted into polysaccharides that are stored in liver in the form of glycogen.

(b) Pancreas, spleen and stomach.

6 *Answer by yourself.*

7 (a) • Hepatic portal circulation.
• Monosaccharides (as glucose) and amino acids.

(b) • Lymphatic route.
• Glycerol and fatty acids.

(c) The blood vessel no. (1) "Hepatic portal vein".

(d) • The blood vessel no. (2) "Hepatic vein" pours in the inferior vena cava.
• The "lymphatic vessel" no. (4) pours in the superior vena cava.

8 (a) 1. No. (4).
2. No. (1) & (2).
3. No. (4).

(b) & (c) : (X).

(d) • The type of blood in the blood vessel no. (2) "Aorta" : oxygenated blood.
• The type of blood in the blood vessel no. (7) "Pulmonary artery" : deoxygenated blood.

9 The body will not be able to filter the lymph from the microbes before its transfer into the bloodstream that passed in the superior vena cava, so that it causes the spreading of microbes inside the body and exposing it to the infectious diseases.

10 Spleen has a great importance in the circulatory system, as the new white blood corpuscles are formed continuously inside it and the red blood corpuscles are destroyed after ending their lifespan, as well as it has a great importance in the lymphatic system, where it is considered one of the most important lymphoid organs in the body that is responsible for providing the body its immunity.



11 (a) The defensive ability of the body will decrease, where structure no. (1) "spleen" is considered from the most important lymphoid organs in the body that are responsible for providing the body its immunity.

(b) The production of white blood corpuscles from structure no. (2) "lymphatic nodes" will increase, when the body is exposed to an infection to destroy the microbe that causes the disease.

(c) The fluid (lymph) that is present in structure no. (3) "lymphatic vessels" contains all the components of plasma, in addition to a large number of white blood corpuscles.

Answers of questions that measure high levels of thinking

1 ⓐ Left atrium.
As the nicotine enters with the inhaled air to the two lungs and after the gases exchange process, it takes the pathway of the pulmonary circulation to reach the left atrium with the oxygenated blood through the pulmonary veins.

---

2 ⓑ Left ventricle ⟶ Aorta ⟶ Renal artery.
As the oxygenated blood enters the kidney through the renal artery. So, the red blood corpuscle pathway starts from the left ventricle to aorta, then to the renal artery.

---

3 ⓑ (L) ⟶ (X) ⟶ (Z).
As stage (L) represents reaching the blood to the two ventricles, as with their contraction the semi-lunar valves open and the blood is pumped in stage (X), then the oxygenated blood is distributed through the aorta to the different body parts and the deoxygenated blood is distributed through the pulmonary artery to the two lungs with the closure of the atrio-ventricular valves to prevent the backflow of blood which is represented by stage (Z).

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4 ⓐ
As it is obvious from section (a) that the increase in the thickness of the left ventricle more than that of the right ventricle.

5 ⓒ Small intestine.
As amino acids and glucose are absorbed from the small intestine to pass through the blood route that includes veins carrying deoxygenated blood in its pathway, which contains a high percentage of carbon dioxide and low percentage of oxygen.

Answers of Test on Chapter 2

1 ⓒ The ventricles relax.

2 ⓐ right atrium.

3 ⓓ Its wall is thick.

4 ⓑ the gases are transferred to it from the surrounding medium by diffusion.

5 ⓑ Heparin.

6 ⓒ Bicarbonate.

7 ⓓ D

8 ⓑ B

9 ⓓ D

10 ⓒ BC

11 ⓑ (2).

12 ⓐ

13 ⓒ (C).

14 ⓒ Hepatic portal vein.

15 ⓒ Both transpiration process and transporting of ready-made food decrease.

16 ⓒ Aeration and storage.

17 ⓓ 130 mm Hg.

18 ⓒ Capillarity phenomenon.

19 ⓒ Blood plasma.

20 ⓐ Vessel no. (1) is an artery carrying oxygenated blood.

---

21 The WBCs count will increase when exposed to an injury as a result of the infection which is caused due to the invasion of microbes.

---

22 As the lymphatic system is considered a transport system, because the lymphatic vessels carry the absorbed food substances (fatty acids, glycerol and fat soluble vitamins) and pass them to the superior vena cava then to the heart.
Also it is considered an immune system, because it produces antibodies and the lymph which has a large number of WBCs. So, it plays a major role in the defensive ability.

---

23 Both of them contain parenchyma cells.

Answers of Chapter 3 Lesson One

First Answers of Multiple Choice Questions

1 (1) ⓐ Energy. (2) ⓐ (X).

2 ⓒ They transfer the energy easily to perform the function of the cell.

3 ⓒ Number of phosphate groups.

4 ⓒ Fructose 1,6-diphosphate.

5 ⓐ ATP

6 ⓓ pyruvic acid

7 ⓑ 6

8 ⓑ 8

9 ⓑ (2C)

10 ⓐ 4

11 ⓒ Two molecules.

12 ⓓ Dark reactions in stroma.

13 ⓓ Four times.

14 ⓑ (2C)

15 ⓒ Oxidation by losing electrons.

16 ⓒ The rate of ATP molecules production will be affected.

17 ⓓ Phosphoglyceraldehyde.

As when phosphoglyceraldehyde is oxidized into pyruvic acid, the ADP molecules combine with phosphate groups which are lost by the phosphoglyceraldehyde molecule to be converted into ATP molecules.

18 ⓓ (L).

As during cellular respiration $6CO_2$ molecules are produced from the complete oxidation of one glucose molecule, therefore cell (L) that contains $18CO_2$ molecules is the cell where 3 glucose molecules are oxidized.

19 ⓓ By losing electrons from glucose.

20 ⓐ Glycolysis.

21 ⓑ They are reduced during Krebs cycle.

22 ⓑ 9

23 (1) ⓓ O_2 / ATP / H_2O / CO_2

(2) ⓐ Coenzymes oxidation.

(3) ⓐ 1

24 ⓒ It moves outwards.

25 ⓒ Before and during Krebs cycle.

26 ⓐ Bean.

27 ⓑ NAD^+

28 ⓑ 34

29 ⓒ In mitochondria and cytosole.

30 ⓒ The oxidation and reduction reactions.

31 ⓐ Glycolysis.

32 ⓐ Glycolysis.

33 ⓐ 2

34 ⓑ 19 : 1

35 ⓐ pyruvic acid.

36 ⓒ Water.

37 ⓐ Zero.

38 ⓓ The formation of lactic acid from pyruvic acid.

39 ⓐ 10 and 2

40 ⓒ 4

41 ⓑ 150 kJ

42 ⓐ The formation of pyruvic acid.

43 ⓑ Oxidation.

44 ⓒ The remaining of energy stored in the pyruvic acid.

As a large amount of energy is released when a larger number of bonds are broken down among carbon atoms in the organic compound, and in the anaerobic respiration a large amount of energy is remained stored in the bonds among 3 carbon atoms in pyruvic acid before its conversion into lactic acid, while in the aerobic respiration a complete breaking down of bonds occurs among the carbon atoms in the glucose molecule to finally produce carbon dioxide and water.

45 ⓑ Bacteria.

As the graph starts with a glucose molecule (6C) that is passed by more than one step till the occurrence of glycolysis and its conversion into pyruvic acid (3C) which is converted to lactic acid (3C) and this type of anaerobic respiration (acidic fermentation) characterizes most of bacteria.

46 ⓑ 10 molecules.

As the entry of one pyruvic acid molecule to complete one Krebs cycle, 3 $NADH_2$ molecules are produced. So, the number of pyruvic acid molecules that gives 30 $NADH_2$ molecules $= \frac{30}{3} = 10$ molecules.

47 ⓐ 150

As after the electron transport chain, each molecule gives 15 ATP molecules (from 4 NADH molecules, 1 $FADH_2$ molecule and 1 ATP molecule directly), i.e. the result of 10 molecules of pyruvic acid = 15 × 10 = 150 ATP molecules.

48 ⓑ 2

As NADH is converted into NAD^+ by losing two electrons which are carried by NADH, and they combine at the end with a pair of H^+, then with an oxygen atom to form water according to this equation :

$$2e^- + 2H^+ + \frac{1}{2} O_2 \longrightarrow H_2O$$

49 ⓑ 15

As the pyruvic acid is converted into acetyl group which produces one molecule of NADH which gives 3 ATP molecules, and the acetyl group combines with the CoA to perform Krebs cycle once and produces :

- 3 NADH molecules that give 9 ATP molecules.
- One $FADH_2$ molecule that gives 2 ATP molecules.
- One ATP molecule directly.

So, the number of the resulted ATP molecules is 15 molecules.

50 ⓐ

As it is obvious that graph ⓐ shows obtaining energy from one glucose molecule during anaerobic respiration in two stages, the first one is glycolysis (splitting of glucose into pyruvic acid) in which the number of carbon atoms decreases into half (3 carbon atoms) and the second one is the fermentation of pyruvic acid into lactic acid (3C) compound.

Second Answers of Miscellaneous Questions

1 Because the majority of living organisms' cells use the glucose molecule to produce energy more than using any other available food molecule.

---

2 As the cellular respiration occurs either in the presence, absence or lack of oxygen at the body temperature (37°C), producing an energy that is stored in the form of ATP molecules, while the occurrence of burning process requires the presence of oxygen at high temperature to oxidize the organic substances, producing energy that is not stored.

---

3 Because energy is released rapidly from each ATP molecule, when it loses a phosphate group to change into an ADP molecule, and this occurs when the cell needs energy.

---

4 **The statement is correct /** As when breaking down the bond that is present between the two phosphate groups, ATP molecule changes into ADP and an amount of energy is released.

---

5 Because glycolysis stage is the first step in the aerobic respiration before entering Krebs cycle and also it is the first step before the fermentation takes place in the anaerobic respiration and both don't require the presence of oxygen, so that it occurs in case of the presence or absence of oxygen to produce energy.

---

6 **The statement is correct /** As proteins are digested into amino acids which are broken to form acetyl groups that combine with the coenzyme (A) to join the Krebs cycle.

---

7 The acetyl groups will not be transferred to the reactions of Krebs cycle, so that the reactions of the cellular aerobic respiration will stop.

---

8 **(a)** • Starch in plant cells.
• Glycogen in animal cells.

(b) Glycolysis / In the cytosole.

(c) They are carried on NAD^+ and FAD molecules to enter in the electron transport chain, in order to release energy from them.

---

9 4 coenzymes (3 NADH & 1 $FADH_2$).

---

10 **The statement is wrong /** As the number of ATP molecules that are formed in one Krebs cycle equals one ATP molecule, i.e. when Krebs cycle is repeated for 4 times, 4 molecules of ATP will be produced directly.

---

11 To remove the electrons that are received by FAD and NAD^+ molecules, in order to transport them to the cytochromes to release the energy required for producing ATP molecules, leading to an increase in the released energy.

12

NAD$^+$	NADP
• Coenzyme which is present in the mitochondria and cytoplasm.	• Coenzyme which is present in the chloroplasts.
• Receives hydrogen (H_2), forming NADH compound.	• Receives hydrogen (H_2), forming $NADPH_2$ compound.
$NAD^+ + H_2 \xrightarrow{Reduction} NADH + H^+$	$NADP + H_2 \xrightarrow{Reduction} NADPH_2$
• Receives the electrons that are removed from the oxidation of carbon atoms during a group of reactions of cellular respiration to transport them to the cytochromes for releasing the energy required to produce ATP	• Carries the hydrogen required to reduce CO_2 for forming carbohydrates during the dark reactions in photosynthesis process.

13 Due to the absence of cytochromes.

14 Case no. (2) / It represents the electron transport chain, because the cytochromes that are present in the inner membrane of mitochondria carry the electrons at different energy levels.

15 *Answer by yourself.*

16 **The statement is wrong** / As the oxidation of a glucose molecule during electron transport chain produces 34 ATP molecules, therefore the oxdidation of 3 molecules of glucose during the electron transport chain produces 102 molecules of ATP

17 As some living organisms can obtain energy from food (glucose) molecule in the absence or lack of oxygen by the help of a group of enzymes through the anaerobic respiration (fermentation), as in yeast and bacteria.

18 2 molecules of lactic acid.

19 As the acetyl groups that are resulted from the breaking down of the fatty acids and amino acids molecules can combine with the coenzyme (A) and join the Krebs cycle, then the electron transport chain without forming pyruvic acid.

20 They resort to the anaerobic respiration, as the pyruvic acid that is resulted from the glycolysis is reduced into lactic acid "acidic fermentation", and produces 2 molecules of ATP

21 (a) The graduated cylinder no. (2) / As carbon dioxide gas that is resulted from the alcoholic fermentation process in yeast increases the volume of the mixture.

(b) • **The importance of no. (1) "acidic fermentation" :** used in dairy industries, such as cheese, butter and yoghurt.

• **The importance of no. (2) "alcoholic fermentation" :** used in the bread and alcohol industries.

22 (a) : (4). (b) : (3). (c) : (1).
(d) : (5). (e) : (2).

23 As the hydrolysis of sugar molecules into glucose occurs to facilitate their use in the anaerobic respiration process through yeast.

24 (a) 1. (3) "Inner membrane of mitochondria".
2. (4) "DNA"

(b) The reason for the presence of structure no. (1) "ribosomes" is the formation of the enzymes required for the aerobic respiration process inside the mitochondria.

(c) The structure no. (3) "cristae" which represent the inner membrane of mitochondria and contain sequences of coenzymes that carry the electrons at different energy levels to accomplish the last stage of aerobic respiration which is the electron transport chain.

25 • **Similarity :** both of them are vital processes that occur in the cells of living organism to obtain the energy stored in food molecules, especially glucose and store it in the form of ATP molecules.

• **The main conditions for the occurrence of fermentation process :**

- The absence or shortage of oxygen.
- The presence of a group of enzymes.



Answers of questions that measure high levels of thinking

1 ⓑ (2) and (4).

As through glycolysis, two ATP molecules and two NADH molecules are produced, as well as one ATP molecule, one $FADH_2$ molecule and 3 NADH molecules are produced by one Krebs cycle.

2 ⓒ 3

As the conversion of one molecule of pyruvic acid into acetyl group includes the production of one NADH molecule which gives 3 ATP molecules.

3 ⓑ 4 molecules.

As the amount of the resulted energy is the net result of the number of ATP molecules that are resulted directly which is two molecules during glycolysis and two molecules from Krebs cycle (twice).

4 ⓑ 24

As through the aerobic respiration reactions for one glucose molecule, 10 NADH molecules and 2 $FADH_2$ molecules are produced, where each one carries two electrons according to the two following equations :

$$NAD^+ + H^+ + 2e^- \rightleftharpoons NADH$$

$$FAD + 2H^+ + 2e^- \rightleftharpoons FADH_2$$

So, the number of the removed electrons from one glucose molecule in the electron transport chain = 2 × 12 = 24 electrons.

5 ⓒ (3).

As at the end of the race, the muscle resorts to the anaerobic respiration, where it consumes all the oxygen that is present in it and resorts to reducing the pyruvic acid into lactic acid till reaching the maximum amount at point (3), and when the oxygen is present after the end of the race the lactic acid is oxidized into pyruvic acid again to complete the aerobic respiration. So, the lactic acid decreases.

6 ⓒ The volume of balloon no. (3) is greater than that of no. (1) and (2).

As in balloon no. (3) alcoholic fermentation occurs to the glucose which produces carbon dioxide gas which increases the volume of the balloon according to this equation :

$$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$$

7 ⓒ The two statements are correct.

As the muscle cells resort to the anaerobic respiration after consuming all the oxygen amount that is found in it, i.e. the anaerobic respiration occurs after the aerobic respiration, as in case of the presence of oxygen during the anaerobic respiration the lactic acid is oxidized to pyruvic acid again, then to CoA to complete the aerobic respiration stages and produce energy.

8 (a) • **W :** maltose. • **X :** glucose.
• **Y :** pyruvic acid. • **Z :** lactic acid.
• (1) : digestion. • (2) : glycolysis.
• (3) : acidic fermentation.

(b) • **The number of carbon atoms decreases into half, on the occurrence of :**

- Step no. (1) : because of the digestion of maltose molecule (disaccharide) by the action of maltase enzyme and the formation of 2 molecules of glucose (monosaccharide).
- Step no. (2) : because of the glycolysis of glucose molecule into 2 molecules of pyruvic acid.

(c) • The presence of maltase enzyme and an alkaline medium (pH = 8) are required to accomplish step no. (1).
• The presence of 2 molecules of ATP is required to accomplish step no. (2).
• The presence of a group of enzymes is required to accomplish step no. (3) in the absence or lack of oxygen.

(d) 4 ATP molecules.

9 (1) 38 ATP molecules.
(2) (3), (2) and (1).

Answers of Chapter 3 Lesson Two

First Answers of Multiple Choice Questions

1 (1) ⓑ (2).
(2) ⓓ In parts no. (2) and (7).
(3) ⓑ (4). (4) ⓐ (1).
(5) ⓒ (2) and (9).

2 ⓒ pharynx.

3 ⓓ Bronchiole.

4 ⓒ Exchanging gases.

5 ⓑ The increase in its surface area.

6 ⓒ Respiratory enzymes.

7 ⓓ They are surrounded by oxygenated and deoxygenated blood.

8 ⓒ The consumption of oxygen.

9 ⓑ Chloroplast / Glucose + O_2 / Mitochondria / ATP

10 ⓑ An amount of sugar is released from it.

11 ⓑ (2).

12 ⓐ The air that enters the two lungs contains a greater amount of oxygen than the air that comes out of them.

13 ⓑ

14 ⓒ Stomata.

15 ⓒ Photosynthesis.

16 ⓒ $C_6H_{12}O_6$

17 ⓒ Remains clear / Becomes turbid.

18 ⓑ chloroplast is reversed in the mitochondria.

As the chemical reactions that are occurred in the chloroplast aim to form the high-energy organic compounds as forming glucose through carbon dioxide gas fixation in the presence of water and light, and the vital functions that the cell performs, need energy which the cell gets from the oxidation of glucose to carbon dioxide gas and water in the mitochondria, and it is shown in the following reactions :

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6H_2O + 6O_2 \uparrow$$

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38\ ATP$$

19 ⓐ Increasing the pH value in blood.

As decreasing the pH value (blood acidity) is related to increasing the carbon dioxide gas level which requires increasing the respiration rate to get rid of it, as well decreasing the haemoglobin level in the red blood corpuscles means decreasing the level of oxygen gas in blood. Therefore, the respiration rate increases according to the body need for more oxygen.

Second Answers of Miscellaneous Questions

1 The microbes and foreign materials will enter into the two lungs with the inhaled air and the nose will be dry, as the hairs inside the nose work as sieves and the mucus works as a moisturizer and filter for air.

2 They filter the air that enters into the alveoli by moving the foreign particles that may be present in it.

3 If the trachea is devoid of cartilaginous rings, the walls of trachea will collapse, leading to its closure, suffocation of the living organism and his death, because these rings keep the trachea opened permanently.

4 To increase the respiration surface area and the occurrence of gas exchange between the alveolar air and blood in the surrounding blood capillaries.

5 The gas exchange process between the alveolar air and blood in the surrounding blood capillaries will not occur.

6 Carbon dioxide is formed in the body cells, as a result of the occurrence of cellular respiration process.

Blood capillaries surrounding the body cells → Veins → Superior and inferior venae cavae → Right atrium of the heart → Right ventricle of the heart → Pulmonary artery → Blood capillaries surrounding the alveoli in the two lungs → Exhaled air (CO_2)

7 The plant will not perform the photosynthesis process, due to the absence of light, therefore the oxygen that is necessary for respiration process isn't produced. So, the plant will wilt and die.

8 The reason for the death of mouse and burning out of candle in figure no. (2) is that all the amount of oxygen that is present inside the bell jar is consumed in the mouse respiration and candle burning processes, while in figure no. (4), the reverse occurs, as the plant performs photosynthesis process, where it consumes CO_2 gas that is resulted from the burning of the



candle to perform photosynthesis process which produces O_2 gas that is used by the mouse to perform respiration process and helps in keeping the candle light.

9 *Answer by yourself.*

10 The plant may perform photosynthesis process by using the carbon dioxide gas that is resulted from the respiration process, therefore the limewater that is present in the beaker next to the plant will not be turbid, therefore the release of carbon dioxide gas during the aerobic respiration in the green plant parts will not be proven.

11 • Removing the aquatic snails and other living organisms that consume the dissolved oxygen in water that is required for fish respiration.

• Planting the aquatic green plants as algae to consume carbon dioxide that is resulted from the respiration of fish and use it in the photosynthesis process for producing the dissolved oxygen in water that is required for fish respiration.

Answers of questions that measure high levels of thinking

1 (1) ⓐ (X). (2) ⓓ (L).

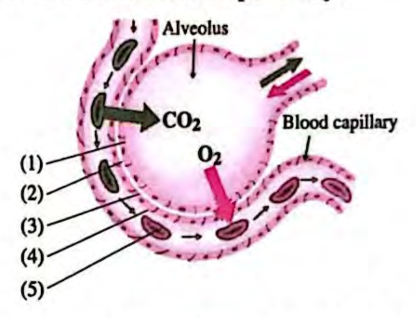
As the columns in (X) represent the normal percentages of gases in the atmospheric air (nitrogen 78%, oxygen 21% and carbon dioxide 0.03%) which enter the two lungs through the inhaled air, and after the gas exchange process occurs in the two lungs the exhaled air comes out with a higher percentage of carbon dioxide gas and a lower percentage of oxygen gas without changing the nitrogen gas percentage which is represented in columns (L).

2 ⓓ Remains constant / Inward.

As in tube no. (1), the small animals respire the oxygen gas during the inhalation process and replaced it by the carbon dioxide gas that is resulted from the exhalation process. So, the amount of air in the tube isn't affected and the ink drop remains constant, while the resulted carbon dioxide in tube no. (2) will dissolve in the limewater, so that the amount of air in the tube decreases. So, the ink drop will move inward as a result of the withdrawal of an amount of air from outside the tube.

3 ⓓ 5 / 5

As during gas exchange between alveolus and blood surrounding it in blood capillaries, oxygen molecule passes from inside the alveolus to inside the red blood corpuscle through 5 plasma membranes which are respectively :



1. Inner membrane of an epithelial cell of alveolus.
2. Outer membrane of the same epithelial cell of alveolus.
3. Outer membrane of an epithelial cell of blood capillaries.
4. Inner membrane of the same epithelial cell of a blood capillary.
5. Membrane of red blood corpuscle.

As well as CO_2 that exists in the red blood corpuscle passes to inside the alveolus through the same plasma membranes but in the opposite direction.

4 Tube no. (3) / As the snail consumes the oxygen that is present in water in respiration process, where there is no source for this gas as in tubes no. (1) and (2), in which the plants perform photosynthesis through which oxygen is produced.

5 **(a)** Clear limewater.

(b) The indicator doesn't change in tube no. (2), as the green plant in the opposite tube performs respiration and photosynthesis processes (i.e. CO_2 that is resulted from respiration process is consumed by the plant in the photosynthesis process), while in the

tube opposite to the tube no. (1), the insect performs respiration process only (i.e. it consumes O_2 and produces CO_2 that makes the indicator "clear limewater" turbid).

(c) The indicator (clear limewater) will be turbid in both tubes no. (1) and (2).

Answers of Test on Chapter 

1 ⓑ

2 ⓓ Each of them depends on the other.

3 ⓓ ATP molecules.

4 ⓐ 1 : 5

5 ⓒ (3).

6 ⓓ Glycolysis – Electron transport chain – Krebs cycle.

7 ⓒ Cell no. (3).

8 ⓒ Lenticels.

9 ⓓ have different source of energy.

10 ⓐ CO_2 and O_2

11 ⓐ One molecule.

12 ⓑ Pyruvic acid reduction.

13 ⓐ Carbon dioxide / Oxygen.

14 ⓒ NAD^+

15 ⓒ Spongy layer.

16 ⓒ electron transport.

17 ⓐ similar, because both have similar cellular enzymes.

18 ⓑ 4

19 ⓑ Reduction.

20 ⓓ It loses electrons.

---

21 Air will be filtered from dust by the nose where contains hairs and mucus that act as filters (sieves).

---

22 Both of them produce 2 ATP molecules, occur in the lack or absence of oxygen and represent reduction reactions.

---

23 **The statement is wrong /** As the respiratory system expels out carbon dioxide, as it has an important role in the excretion of some water with the exhaled air in the form of water vapour, at which the human loses 500 cm^3 of water per day through lungs out of 2500 cm^3 daily.



Test Yourself Questions

Answers of Chapter 1 Lesson One

1. ⓐ Plant (1) represents the host for plant (2).

2. 1 ⓑ (2).
   2 It will loses water, as the concentration of the solution inside the sap vacuole of the root hair is less than the concentration of the soil solution.

3. 1 ⓑ From (Y) to (X) by osmosis.
   2 ⓓ
   3 ⓐ high in both of them.

4. ⓑ

5. 1 ⓒ Active transport and diffusion respectively.
   2 ⓑ

Answers of Chapter 1 Lesson Two

1. 1 (1) ⓐ (X).
   (2) ⓒ (Z). (3) ⓐ (X).
   2 ⓐ Mg

2. 1 ⓒ Palisade layer.
   2 ⓒ The first statement is correct and the second statement is wrong.

3. 1 ⓑ Sulphur / Glucose. 2 ⓓ
   3 ⓑ Glucose and water.

4. 1 (1) ⓑ During dark reactions.
   (2) ⓒ CO_2 gas isn't fixed up.
   2 As the glucose molecule is hexa carbon sugar which is resulted from binding two molecules of phosphoglyceraldehyde which consists of three carbon atoms.
   Phosphoglyceraldehyde molecule (3C) + Phosphoglyceraldehyde molecule (3C) ⟶ Glucose molecule (6C)

Answers of Chapter 1 Lesson Three

1. ⓑ (1) and (3).

2. 1 ⓑ The concentration of disaccharides at point (b) is more than that at point (a).
   2 ⓓ The structure of starch and the shape of amylase enzyme.

3. 1 ⓑ The action of ptyalin enzyme continues.
   2 ⓐ A disturbance in the muscle that controls the cardiac sphincter.

4. 1 ⓓ The digestion of fats. 2 ⓓ Fats.
   3 ⓓ Peptidase. 4 ⓓ Amylase.

5. 1 ⓐ Thin and rich in blood capillaries.
   2 ⓐ Fatty acids.

6. The mucus exists along the human alimentary canal in :
   1. Mouth : as it contains the salivary glands which secrete saliva that contains mucus that softens food and facilitates its swallowing.
   2. Oesophagus : as its lining contains glands that secrete mucus that facilitates pushing food and transferring it to the stomach by the help of peristalsis.
   3. Stomach : as its inner wall secretes heavy mucuos secretions that protect it from the effect of the digestive enzymes.
   4. Large intestine : as it secretes mucus which facilitates the passage of food wastes out of the body.

Answers of Chapter 2 Lesson One

1. 1 ⓐ The two statements are correct.
   2 ⓑ Leaves and phloem tissues.

2. 1 ⓑ Transport. 2 ⓒ

3. 1 (1) ⓒ *Pinus*.
   (2) ⓒ Its presence is limited on the walls of xylem vessels.
   2 As the rates of transpiration and evaporation in plant increase with increasing the atmospheric temperature especially at noon. So, the stomata open and the water vapour

that is present in the air chambers will be lost from the leaves. So, the water that presents in xylem vessels is under the effect of a great pulling force, therefore the water raises in xylem vessels and tracheids of stem and root connected with each other. So, water transports in plant faster at noon than night to compensate the lost water.

4 ⓐ The rate is higher.

Answers of Chapter 2 Lesson Two

1 1 ⓒ The mitral valve regurgitation (backward flow).

2 ⓐ AB

2 ⓐ Aorta.

3 1 ⓑ 46%

2 Protecting the body through :

- Attacking microbes (by surrounding, then engulfing them).
- Stopping the foreign substances that are produced by microbes in blood.
- Getting rid of dead cells and other wastes.

4 1 ⓓ The absence of one of the blood clotting factors from blood.

2 ⓓ Heparin.

5 ⓐ On contracting the left atrium.

Answers of Chapter 2 Lesson Three

1 ⓑ The opening of the bicuspid valve.

2 1 (1) ⓒ Pulmonary vein.

(2) ⓑ (3) ⟶ (1) ⟶ (4) ⟶ (2).

2 As the left ventricle pushes the blood from heart to all the body parts (long distance), while the right ventricle pushes the blood from heart to the two lungs (short distance).

3 1 ⓓ Small intestine ⟶ Hepatic portal vein ⟶ Liver ⟶ Hepatic vein ⟶ Inferior vena cava.

2 ⓑ Liver.

4 1 ⓒ Prothrombin. 2 ⓐ Right atrium.

Answers of Chapter 3 Lesson One

1 ⓓ By forming a bond between two phosphate groups in the presence of energy.

2 ⓒ 360 kcal/mol.

3 1 (1) ⓐ 2 molecules of ATP

(2) ⓐ Citric acid.

2 They enter into the blood circulation combined with RBCs haemoglobin and after the gas exchange in two lungs they exit with the exhaled air.

4 1 ⓒ The occurrence of complete oxidative phosphorylation process.

2 ⓑ 4 ATP molecules.

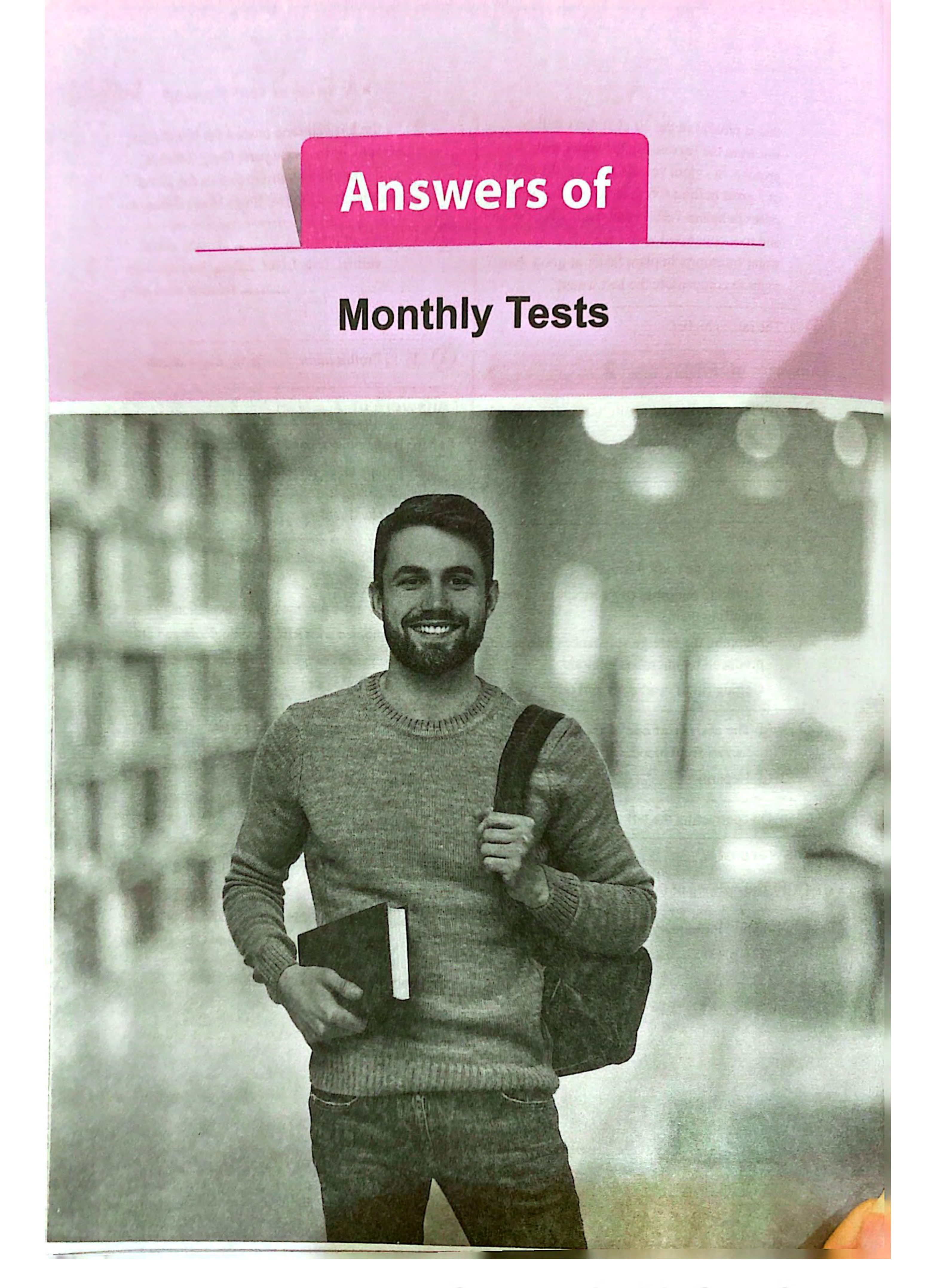
5 ⓑ Oxygen.

6 ⓒ Unchanged / Inflate.

Answers of Chapter 3 Lesson Two

1 ⓒ (1) ⟶ (2) / Deoxygenated / Oxygenated

2 Each of them contains DNA molecules.


Answers of
Monthly Tests

Answers of Test 1 on the 1st Month

1 ⓑ Maltose.
2 ⓐ Plant (1) parasitises on plant (2).
3 ⓓ Activation of chlorophyll molecules.
4 ⓑ Active transport.
5 ⓓ normal oxygen and normal carbon
6 ⓐ oesophagus and stomach.
7 ⓒ
8 ⓐ Palisade tissue.
9 ⓑ Diffusion.

10 As the effect of the salivary amylase enzyme (ptyalin) continues during the passage of food in the oesophagus, therefore the digestion of carbohydrates continues into maltose sugar.

11 The root hairs won't absorb water and mineral salts, because cutin substance is impermeable to water and mineral salts, leading to the plant death.

12 Water is considered the source of hydrogen that is required for the carbon dioxide fixation during dark reactions of photosynthesis process.

Answers of Test 2 on the 1st Month

1 ⓑ it secretes a colloidal substance.
2 ⓑ It has a reversible effect.
3 ⓒ voluntary, then involuntary process.
4 ⓐ The formation of (3C) compound / Splitting of a water molecule.
5 ⓒ 5 atoms of macro-nutrients.
6 ⓑ (Y).
7 ⓒ xanthophyll
8 ⓑ Diffusion.
9 ⓓ *Orobanche*.

10 As the pancreatic amylase digests carbohydrates, so that it is secreted in an active form which doesn't affect the pancreatic tissues that secrete it, as they are formed of protein, while pepsin enzyme digests proteins, so if it is secreted in an active form, it will affect the stomach lining cells.

11 The absorption of water and mineral salts from the soil decreases.

12 As the plasma membranes of the plant cells are semi-permeable membranes, as well they are selective permeable to prevent the passage of macro-molecules like proteins that are formed by these cells.

Answers of Test 1 on the 2nd Month

1 ⓑ The formation of bile juice.
2 ⓐ Temperature.
3 ⓒ Right atrium.
4 ⓐ 10 mm Hg.
5 ⓓ It vanishes.
6 ⓑ The presence of mucus.
7 ⓐ The blood pressure in vein is low.
8 ⓓ Potato.
9 ⓐ (1) / Oxygen.

10 **The statement is wrong** / As the re-combination of some glycerol and fatty acids takes place to form fats and these fats are directed to the lacteal vessels inside villi, then to the lymphatic system which carries them slowly to pour them in the superior vena cava of the heart.

11 The rate of water and mineral salts transport decreases from the root to the leaf.

12 As the point (A) "atrio-ventricular node" is stimulated when the electrical nerve impulse reaches it from the point (B) "sino-atrial node".

Answers of Test 2 on the 2nd Month

1 ⓑ receives the gases from the surrounding medium by diffusion.

2 ⓓ Intestine.

3 ⓐ They don't pulsate.

4 ⓒ Transport process in phloem needs the presence of ATP molecules.

5 ⓒ The absorption rate of amino acids decreases.

6 ⓑ Closure of tricuspid valve.

7 ⓐ fast at noon and slow at night.

8 ⓒ Contraction of left ventricle / Contraction of right atrium.

9 ⓒ Absence of chromosomes.

---

10 The thickness of the plant stem doesn't increase, due to the absence of cambium (meristematic cells) which divides to give a secondary phloem externally and a secondary xylem internally.

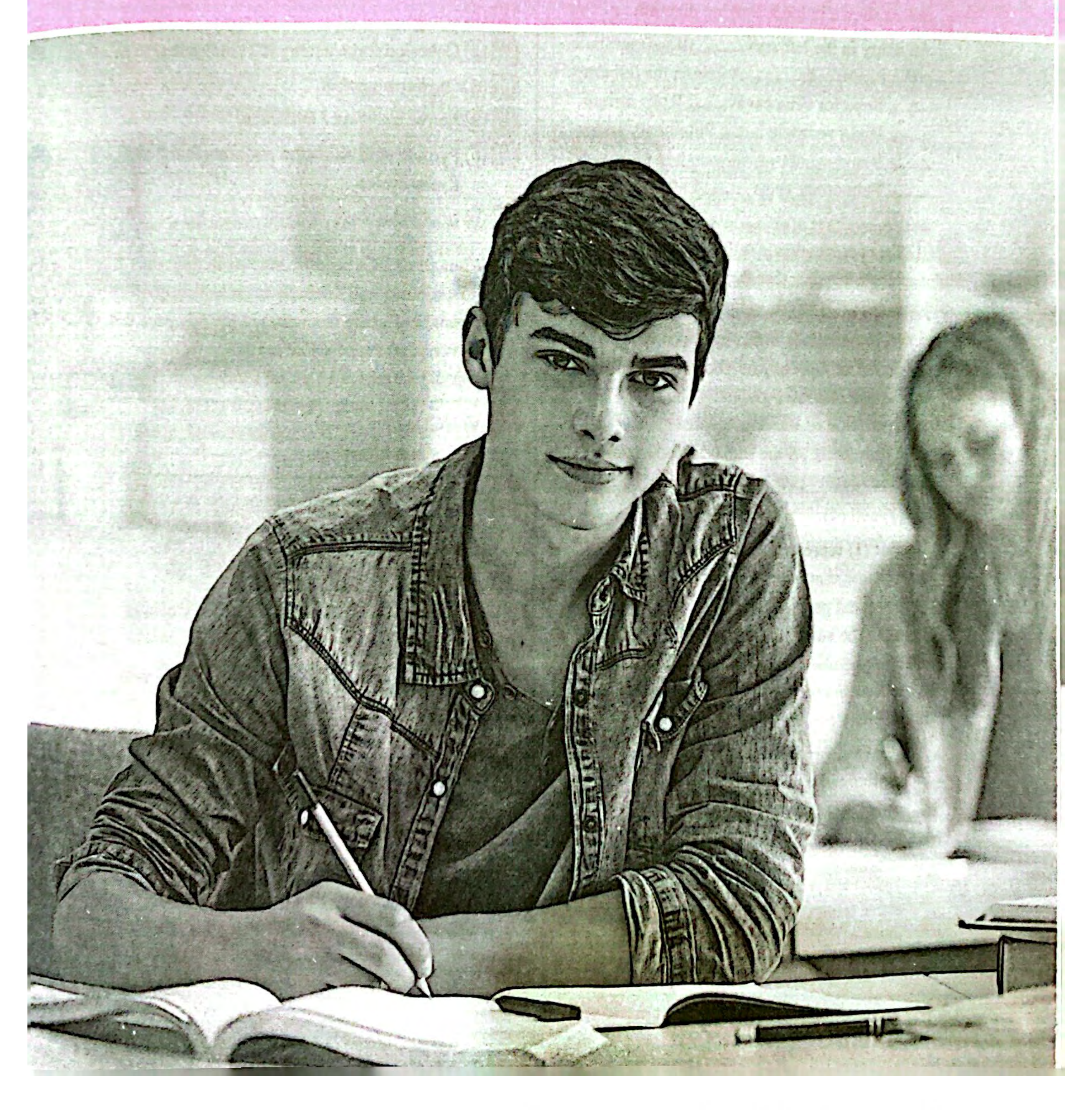
11 As the sympathetic nerve that is connected to the heart sino-atrial node acts on increasing the rate of heartbeats during performing a vigorous physical activity, such as boxing.

---

12 As the wastes of undigested food pass to region (X) from the large intestine first, then pass to region (Y), with continuing the absorption process of water and a part of salts through the convolutions that are present in the lining of large intestine. So, the wastes in region (Y) become more solid than the wastes that found in region (X).

Answers of

10 General Exams



Answers of General Exam 1

1 (c) (Z) & (Y).

2 (d) Lactic acid from pyruvic acid.

3 (a) (1).

4 (b) Vascular bundle / Pericycle / Cortex / Epidermis.

5 (d) The storage of the raw materials required to photosynthesis.

6 (b) 2

As the number of the blood capillaries sites is two as shown in the following diagram :

An artery in the left arm ⟶ Blood capillaries in the thumb cells ⟶ A vein in the left arm ⟶ Superior vena cava ⟶ Right atrium ⟶ Right ventricle ⟶ Pulmonary artery ⟶ Blood capillaries surrounding the alveoli ⟶ Pulmonary veins ⟶ Left atrium ⟶ Left ventricle.

7 (d) The concentration of maltose in the fourth minute is higher than the concentration of starch.

As amylase enzyme acts on the hydrolysis of starch into maltose sugar, by the continuity of the action of this enzyme, the concentration of maltose increases gradually and the concentration of starch decreases gradually till hydrolyzing all the starch molecules into maltose.

8 (d) (1) and (4).

As part (1) represents the xylem tissue in the leaf section that is present in the vascular bundle outward and part (4) represents also the xylem tissue in the stem section that is present in the vascular bundle inward, where the xylem tissue is responsible for the transport of water and salts in the plant. So, the two parts (1) and (4) are stained by the coloured water.

9 (c) Fibrinogen.

10 (c) Respiratory enzymes.

11 (a) A piece of meat.

12 (b) Sugars and amino acids transfer together by active transport in the same sieve tube of phloem.

As from the important vital processes that is performed by the sieve tube in phloem is the active transport of sugars and amino acids against the concentration gradient and this process requires energy that is given to the sieve tube in the form of ATP molecules from the mitochondria of the companion cell through the plasmodesmata which connect the cytoplasm of companion cell with the cytoplasm of sieve tube.

13 (b) 70 mm Hg.

14 (c) Meat and juices.

15 (a)

16 (a) Cohesion force among H_2O molecules.

17 (d) Oxyhaemoglobin.

18 (a) Active transport / Diffusion.

19 (b) Pyruvic acid oxidation and completing two Krebs cycles.

20 (b) It will shrink.

---

21 When the RBCs become senescent, they are broken down and the body restores their proteins to use them in the formation of the bile juice that converts fats into emulsified fats to facilitate their digestion.

---

22 **(a)** HCl acid.

(b) Sodium bicarbonate.

---

23 The absence of co-enzymes or cytochromes.

Answers of General Exam 

1 (b) (2).

2 (a) cytoplasm.

3 (c) Peptidase.

4 (c) The percentage of N_2 in the inhaled air with its percentage in the exhaled air.

As nitrogen enters with the inhaled air and comes out with the exhaled air without spreading in blood.

5 (c) The first statement is correct and the second statement is wrong.

6 (c) P

7 (b) Liver.

8 (b) Fatty acids.



9 ⓐ Water and soluble proteins.

As the enucleated cells are the red blood corpuscles that are found in the blood fluid (Y) that shares with lymph (X) in the presence of plasma and its components from water and soluble proteins that are expressed by (Z).

10 ⓑ passes in a cavity with different width.

11 ⓓ H_2O splitting in the photosynthesis process.

12 ⓓ The exit of water from the lips' cells leads to their shrinkage.

13 ⓒ 8

14 ⓐ Superior vena cava.

15 ⓑ Lactic acid / Glucose.

16 ⓒ Left ventricle.

17 ⓒ High / Low

18 ⓐ ATP

19 ⓓ Sap transfer.

20 ⓓ Cactus.

21 The solution in tube (X) remains clear, as the boiling kills the protoplasm. So, seeds can't respire.

22 As the leaves in which the high-energy organic food substances (carbohydrates, fats and proteins) are manufactured and they will be transported through the sieve tubes of the phloem to the different plant parts for storage and consumption.

23 (a) (2) Pancreas.
(b) (1) Stomach.

Answers of General Exam 3

1 ⓑ Hepatic portal vein.

2 ⓐ

As the plant absorbs water through the xylem vessels that are present in the vascular bundle inward of the plant stem. So, it appears coloured in the transverse section.

3 ⓓ The iron and haemoglobin levels decrease in blood.

4 ⓒ The absorption of macro-nutrients only.
As the diffusion of elements against the concentration gradient requires the occurrence of active transport that takes place in the presence of the energy stored in ATP molecules that contain a macro-nutrient element which is phosphorus element, where these molecules are supplied to the plant through the cellular respiration in the presence of respiratory enzymes at which some of them need to be activated by some micro-nutrients.

5 ⓓ Opening of aortic valve.

As during the relaxation of the two atria, the two ventricles are in case of contraction, where the atrio-ventricular valves (tricuspid and mitral valves) are closed, and the pulmonary and aortic valves are opened.

6 ⓑ (2).

7 ⓓ The formation of thromboplastin by blood platelets.

8 ⓒ When the two atria contract, the semi-lunar valves open.

9 ⓐ The difference in the released energy amount from one molecule of glucose.
As the fermentation in yeast is alcoholic fermentation that results in (2C) compound (ethyl alcohol) and carbon dioxide, while the fermentation in a fatigued muscle fiber is acidic fermentation that results in (3C) compound (lactic acid) only, i.e. the yeast fermentation in which the breaking down of a large number of bonds among carbon atoms in pyruvic acid takes place. Therefore, a large number of kilocalories will be resulted from the hydrolysis of ATP molecules.

10 ⓒ The enzymes that are present in them become damaged by heating and cooking.

11 ⓓ Oxygen.

12 ⓓ 8

13 ⓑ (B).

14 ⓐ Epithelial layer.

15 ⓑ O_2 / CO_2

16 ⓓ Spleen.

17 ⓐ

18 ⓒ The release of O_2 gas.
As the presence of ATP molecules in a greater number than ADP molecules characterizes the light reactions where ADP is converted into ATP through which the splitting of water molecules takes place to release O_2 gas, while the oxidation of $NADPH_2$ and the reduction of CO_2 gas are two processes occurred in the dark reactions.

19 ⓐ The oxidation of lactic acid.

20 ⓒ

21 Both of them can take place in the absence of oxygen.

22 • Part (X) : the iodine solution doesn't change.
• Part (Y) : the iodine solution changes into dark blue colour.

23 **The statement is correct** / Because the blood flow in arteries occurs under high pressure, due to the thick pulsating muscular walls of the arteries middle layer that contract and relax under the control of nerve fibers and they have endothelium topped with elastic fibers which provide the arteries with the required elasticity to pump the blood during ventricles contraction. But veins carry the blood under low pressure as they have thin muscular walls of their middle layer that can't pulsate and also their endothelium has rare elastic fibers and some of them have valves to prevent the backflow of blood, allowing its passage in one direction (to the heart), as the veins of the limbs that are present near to the skin surface.

Answers of General Exam 4

1 ⓑ

2 ⓓ 3-carbon compound is formed in each one of them.

3 ⓒ Pulmonary vein.

4 ⓓ 8
To obtain the energy from a molecule of maltose, it is hydrolyzed first into two glucose molecules, where the oxidation of one glucose molecule gives 4 molecules of CO_2. So, when Krebs cycle occurs twice, therefore maltose molecule gives 8 molecules of CO_2

5 ⓑ

6 ⓓ $NADPH_2$ and ATP

7 ⓑ Carbo-aminohaemoglobin.

8 ⓒ One Krebs cycle.
As ATP molecules are produced directly through two stages (glycolysis and Krebs cycle only), where 2 ATP molecules are produced from glycolysis, and one ATP molecule only is produced from one Krebs cycle.

9 ⓓ Starch sheath / Collenchyma / Parenchyma.

10 ⓒ Pancreas.

11 ⓐ Water.

12 ⓑ The mixing of some oxygenated blood with the deoxygenated blood.

13 ⓓ Amino acids.
As the decrease in the amount of food substance in stomach into its half (50 g) indicates the occurrence of its partial digestion, i.e. it is formed of protein (it is the substance which starts to be digested in stomach) and the continuity of decreasing its amount in the small intestine where the digestion of protein into amino acids is completed at the end.

14 ⓒ Prothrombin.

15 ⓐ Opening the valve when the muscles contract.

16 ⓒ Diffusion.

17 ⓑ Opening the tricuspid valve and the closure of aortic valve.

18 ⓓ Lipase enzyme.

19 ⓒ Active transport and permeability.

20 ⓓ Glycine and fat droplets.

21 Xylem vessels and tracheids.

22 $FADH_2$

23 The RBCs will shrink slightly when the saline concentration is 1%, as they lose water, while they burst when the saline concentration is 0.5% and this happens due to the transfer of water molecules by osmosis from the highly-concentrated medium (low salts concentration) to the lower concentrated medium (high salts concentration) to inside the cells, which make them swell then burst, due to the absence of the cell wall in their structure.

Answers of General Exam 5

1 ⓓ (4).
As cell (4) receives water from the two cells (2) and (3) which receive water from cell (1).



So, cell (4) has the least concentration of water, therefore it has the highest concentration of salts before water transferring.

2 (d) This person has an increase in the number of RBCs.

3 (c) The production of a large amount of NADH molecules.

4 (d) The closure of semi-lunar valves.

5 (c) The highest flow of water in the stem is delayed than the highest transpiration rate.
As the highest rate of transpiration is nearly at 8 am, then followed by the highest rate of water flow in the stem after nearly 10 am, because the water flow in the stem depends on the occurrence of the transpiration process.

6 (a) (1).

7 (b) They work at the same pH value.

8 (d) Oxygen.

9 (c) (2) & (3).
As the oxygenated blood is transported from the two lungs to the heart by blood vessels (2) "pulmonary veins", then coming out from the heart to the rest of the body parts through blood vessel (3) "aorta".

10 (a) The carbohydrates digestion continues.

11 (c) Specific enzymes.

12 (d) When it becomes equal to the pressure of water column in xylem vessels.

13 (a) Difficulty in the light passage.

14 (c)

15 (d) Cell membranes.

16 (c) Oxidative phosphorylation.

17 (a) Hepatic portal vein.

18 (b) The concentration of salts in the solution is more than their concentration in the blood cells.

19 (b) 4

20 (d) Two macro-nutrients.

21 As the salivary amylase enzyme works on the hydrolysis of the carbohydrates, so that it is secreted in an active form which doesn't affect its salivary glands secretory tissues that are formed of protein. While trypsin enzyme is secreted in an inactive form as it works on the hydrolysis of protein substances, therefore if it is secreted in an active form, it will affect its pancreatic secretory cells.

22 *Answer by yourself.*

23 **The statement is correct** / As the speed of transferring the food substances in phloem depends on temperature and O_2, so that if the temperature decreases or in case of O_2 deficiency, the cytoplasm movement and its streaming in the sieve tubes slow down, leading to the delay of the speed of the food substances transfer.

Answers of General Exam 6



1 (c) Calcium.

2 (d) Performing an immune function.

3 (d) Cambium.

4 (a) (1) is hydrolysis and (2) is catabolism.
As the presence of 38 ATP molecules in the products indicates the occurrence of aerobic respiration, i.e. (B) expresses glucose molecule that is broken in process (2) and this molecule is resulted from the hydrolysis (1) of disaccharide (A) which contains double the number of carbon atoms.

5 (c) A source for hydrogen that is required for the reduction process.

6 (b) Intercellular spaces ⟶ Cell wall ⟶ Plasma membrane ⟶ Cytoplasm ⟶ Plastid's membrane.

7 (d) O_2 from (B) to (A)

8 (a) The two statements are correct.
As the villi of the small intestine act on absorbing the digested food to pass into blood or lymph, while the convolutions of the large intestine act on absorbing water and some salts.

9 (d) The opening of semi-lunar valves.
As the number (110) represents the upper

number when measuring the blood pressure which expresses the contraction of ventricles. So, the closure of the valves with flaps and opening of the semi-lunar valves happen.

10 ⓐ (1).

As the aorta contains oxygenated blood with the highest level of O_2 and the lowest level of CO_2 gas.

11 ⓓ Peptidase enzymes in small intestine.

12 ⓒ Starch.

13 ⓑ The presence of deoxygenated blood.

14 ⓑ Glucose.

15 ⓑ Diffusion and active transport.

16 ⓑ Energy consumption.

17 ⓒ Stopping the light and dark reactions.

As the transport of water from inside the xylem vessels to outside is stopped. So, it doesn't reach the leaf cells which leads to stopping the light reactions, therefore the dark reactions are also stopped.

18 ⓓ Artery / Vein / Blood capillaries.

19 ⓒ

To produce energy only, aerobic respiration occurs, in which the fetus cells need one glucose molecule and 6 molecules of O_2 according to the following equation :

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$$

20 ⓑ Lack of O_2 in the soil.

---

21 Arrow no. (4) / Aorta artery.

---

22 *Answer by yourself.*

---

23 The pulmonary artery.

Answers of General Exam 7

1 ⓑ (B).

2 ⓒ A higher percentage of CO_2 and a lower percentage of O_2

3 ⓒ The type of chlorophyll and the source of hydrogen required to reduce CO_2 in each one of them.

4 ⓑ (2).

5 ⓑ Mitral valve and aortic valve.

6 ⓒ Cellulose.

7 ⓓ Left ventricle contraction.

8 ⓒ ✓ / ✓ / ✓

9 ⓓ Converting organic compounds into inorganic compounds.

10 ⓓ *Pinus*.

11 ⓓ It loses electrons.

12 ⓓ Each of them produces CO_2

13 ⓓ (X) & (Z). **14** ⓒ

15 ⓐ Water and salts absorption completely stops.

16 ⓐ An increase in the transport rate.

17 ⓓ (2) only.

18 ⓓ (C) ⟶ (A) and (B) ⟶ (A).

19 ⓑ Spongy tissue.

20 ⓒ 4

As the result of digesting a maltose molecule is two glucose molecules, and each glucose molecule enters a Krebs cycle in the form of two molecules of acetyl groups, i.e. Krebs cycle occurs 4 times. So, the resulted number of ATP molecules will be 4 molecules.

---

21 As vitamin (K) which plays an important role in the clot formation dissolves in fats that are transported by the lymph route.

---

22 • Enzyme (1) : pepsin enzyme.
• Enzyme (2) : trypsin enzyme.

---

23 *Answer by yourself.*

Answers of General Exam 8



1 ⓒ CO_2 that is required to perform photosynthesis process.

2 ⓒ A decrease in the number of red blood corpuscles.

As the decrease in the number of red blood corpuscles is followed by a decrease in the haemoglobin level (suffering from anemia), therefore a decrease in the oxygen level in blood



occurs. So, the body needs excess oxygen to increase the respiration rate that is accompanied by an increase in the heartbeats for pumping the oxygenated blood in the appropriate rate by the heart.

3 ⓓ 5

4 ⓑ C ↓

5 ⓑ Dark reactions only.

6 ⓓ The innermost row of cortex.

7 ⓑ Vein.

As the blood passes in vessel no. (3) with a low blood pressure which characterizes veins.

8 ⓐ 1 : 5

9 ⓑ He can eat fats in small amounts.

10 ⓑ Imbibition.

11 ⓓ

As glycolysis process requires the presence of two ATP molecules. So, the storage decreases to 8 molecules, where the total produced energy of the glucose aerobic oxidation is 38 ATP molecules. Therefore, the total number of ATP molecules in the cell increases after the complete oxidation of glucose to reach 46 molecules.

12 ⓓ Cell (3) & Cell (5) / Cell (2) & Cell (4)

13 ⓒ 7 g

14 ⓑ (B).

As the glycolysis occurs in the cytoplasm that results in two NADH molecules and two ATP molecules.

15 ⓓ Meat.

16 ⓑ Hepatic portal vein.

17 ⓒ The dark reactions in both of them.

18 ⓑ Lymphatic vessels.

19 ⓑ Increasing the concentration of the cell sap of root cells.

20 ⓓ Opening the aortic valve.

---

21 • 2 NADH molecules. • 2 CO_2 molecules.
• 2 Acetyl co-enzyme (A) molecules.

---

22 • Blood capillaries in villi : the arterial blood capillaries carry oxygenated blood, while the venous blood capillaries carry deoxygenated blood.
• Blood capillaries in alveoli : the arterial blood capillaries carry deoxygenated blood, while the venous blood capillaries carry oxygenated blood.

---

23 **The statement is correct** / As the stomach secretes the gastric juice which contains HCl acid that creates an acidic medium which helps in killing the harmful bacteria that may enter with food.

Answers of General Exam 9

1 ⓑ In gastric juice.

2 ⓓ One Krebs cycle.

3 ⓐ Bile.

4 ⓑ A blood vessel buried among muscles.

As the oxygenated blood with light red colour is found in arteries which are the blood vessels buried among muscles, i.e. the blood sample was taken from the artery.

5 ⓐ Most of the released water from the leaf gets out through the stomata.

6 ⓐ The water pressure decreases inside the leaf cells with increasing the transpiration process.

7 ⓓ The production of ADP from ATP in the stroma.

8 ⓐ Bile juice.

9 ⓐ from the alcoholic fermentation is greater than that from the acidic fermentation.

10 ⓒ The need for energy.

11 ⓑ Renal artery / Renal vein.

As the blood enters the two kidneys in the form of oxygenated blood through the renal artery and comes out in the form of deoxygenated blood through the renal vein, while the opposite occurs in the pulmonary artery, but in the hepatic vein and vena cava the blood enters the heart in the form of deoxygenated blood and comes out in the same form.

12 ⓐ Cambium.

13 ⓓ Active transport to the venules (venous capillaries).

As the starch is digested into glucose molecules (monosaccharaides) that pass in the blood route that are absorbed by active transport to reach the venules then pour into the hepatic portal vein.

14 ⓓ Plenty of O_2 inside the root cells.

15 ⓒ System (X) is closed and system (Y) is opened.

16 ⓐ Amylase and maltase.

17 ⓐ more than

18 ⓒ

19 ⓓ (2) and (4).

20 ⓓ Plasma membranes and cellulose walls.

21 If element (X) "$^{14}CO_2$" is supplied intermittently, dark reactions would take long time or wouldn't happen, because CO_2 is needed for the formation of glucose which is formed through several intermediate reactions, whereas the phosphoglyceraldehyde (PGAL) which is formed quickly "after 2 seconds" in the main experiment is used in building glucose. So, the nature of dark reactions can't be detected or revealed.

22
- Because the medicine may be affected by the stomach acidity or it's difficult to be absorbed through the small intestine.
- To reach the blood faster, as it enters the systemic circulation directly.

23 **The statement is correct** / As when the O_2 is available, the oxidation of the resulted lactic acid from anaerobic respiration occurs into pyruvic acid once more, then to acetyl Co.A to complete the aerobic cellular respiration stages and produce the energy.

Answers of General Exam 10

1 ⓐ Stomach and small intestine.

2 ⓐ The oxidation of phosphoglyceraldehyde aerobically.

3 ⓒ Heparin.

4 ⓑ (Y).

As the concentration of element (Y) in the soil is less than that in the plant cells. So, the plant absorbs it by active transport which requires an energy that the plant needs in the form of ATP molecules that are resulted from the oxidation of glucose during the cellular respiration.

5 ⓓ Cambium.

6 ⓒ $C_{55}H_{70}O_6N_4Mg$

7 ⓓ Tricuspid valve and pulmonary valve.

8 ⓐ Artery.

As the blood passes in the blood vessel (1) with high blood pressure that distinguishes arteries.

9 ⓑ It occurs inside the mitochondria.

10 ⓑ Diffusion.

11 ⓐ

12 ⓓ RBCs.

As the living RBCs carry the oxygen on the haemoglobin that is present in them and transfer it from the two lungs to all the body parts and also transfer carbon dioxide from all the body parts to the two lungs, as well after the breaking down of old red blood corpuscles, the body restores the proteins that are found in them to use them in the formation of bile juice which plays an important role in the digestion of fats.

13 ⓑ Sucrase.

14 ⓐ Pancreas.

15 ⓑ 6

16 ⓐ The presence of DNA molecules.

17 ⓑ Movement of chlorophyll molecule electrons.

18 ⓑ (1) & (4).

As vessels (1) carry deoxygenated blood that is pumped to the two lungs (i.e. they represent the pulmonary artery and its branches) and vessels (4) carry oxygenated blood that is pumped to the different body parts (i.e. they represent the aorta and its branches). Therefore, arteries carry blood at high pressures.

19 ⓓ Water and salts are transferred by capillarity phenomenon.

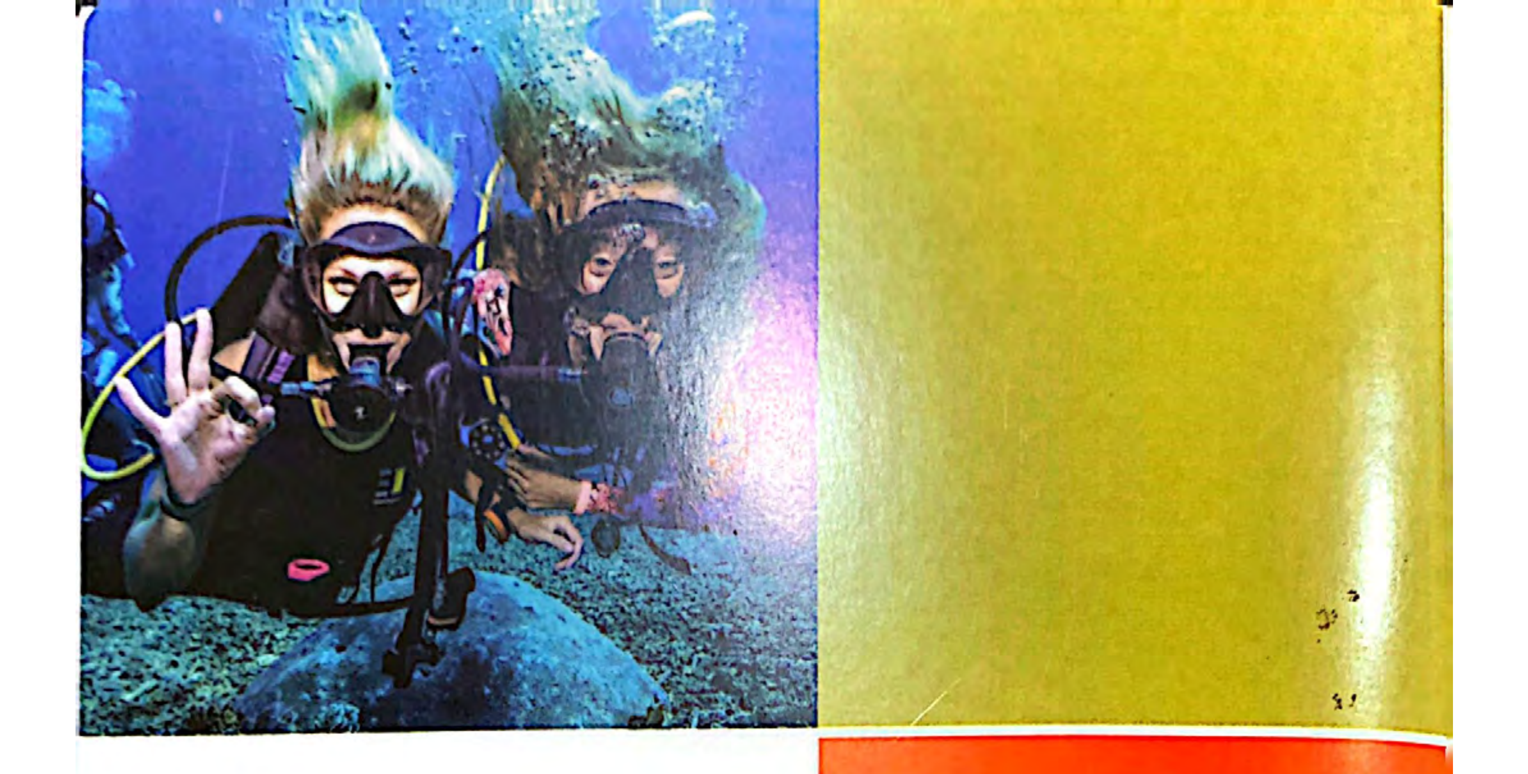
20 ⓓ

21 2 NADH = 3 $FADH_2$ = 6 ATP

22 Liver.

23 (1) The nature of dark reactions in photosynthesis.

(2) The role of sieve tubes in transporting the ready-made food substances to all the plant parts.



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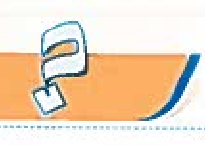


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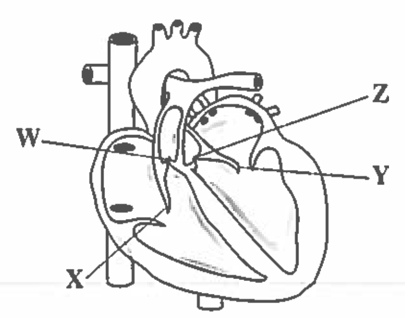


General Exam 1



Choose the correct answer (1 : 21) :

1 The opposite figure shows a longitudinal section in the heart, which of the following valves prevent the back flow of oxygenated blood ?



ⓐ (W), (Y).
ⓑ (W), (X).
ⓒ (Y), (Z).
ⓓ (Y), (X).

2 Which of the following conversions includes the oxidation process of coenzymes ?

ⓐ Pyruvic acid from phosphoglyceraldehyde.
ⓑ Succinic acid from ketoglutaric acid.
ⓒ Malic acid from succinic acid.
ⓓ Lactic acid from pyruvic acid.

3 In an experiment, a student put four potato slices (the length of each slice was 5 cm) in salt solutions with different concentrations, then he recorded the results in the following table, depending on the recorded results, which of the following expresses the solution that has the highest concentration ?

Salt solution	The length of the slice after 30 minutes
ⓐ	4.5
ⓑ	4.8
ⓒ	5
ⓓ	5.3

4 Which of the following represents the correct arrangement of the stem tissues from inside to outside ?

ⓐ Epidermis / Cortex / Vascular bundle / Pericycle.
ⓑ Vascular bundle / Pericycle / Cortex / Epidermis.
ⓒ Vascular bundle / Epidermis / Cortex / Pericycle.
ⓓ Pericycle / Vascular bundle / Cortex / Epidermis.

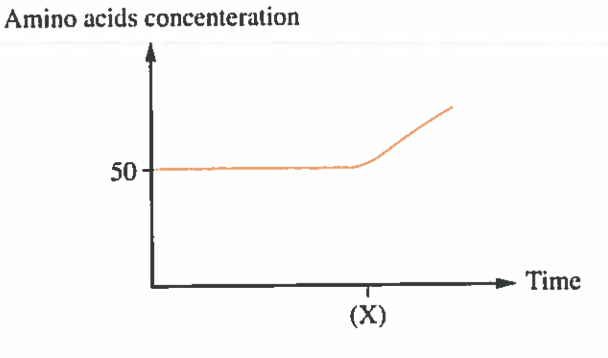
5 A green potted plant was placed on a glass plate and a small beaker containing clear limewater was put next to it and each of them is under a glass bell-jar, and they were left for period of time exposed to light, what will you observe ?

a) Limewater becomes turbid.
b) Limewater becomes turbid, then the turbidity disappears.
c) ~~Limewater is clear.~~
d) The colour of limewater changes into dark red.

6 A red blood corpuscle begins its journey from an artery in the left arm directed to the thumb cells for supplying them with oxygen, then it returns back to the left ventricle. What is the number of sites of the blood capillaries through which the red blood corpuscle passed during its journey ?

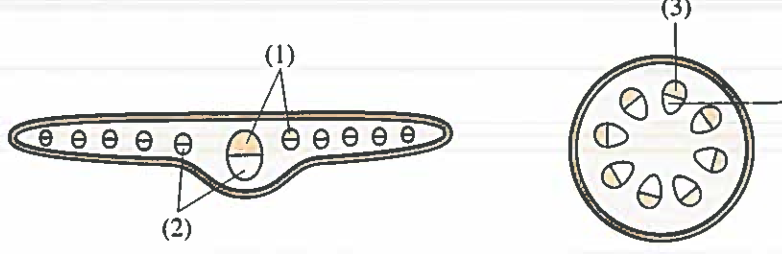
a) 1 b) 2 c) 3 d) 4

7 In the opposite graph, which of the following enzymes is responsible for changing the concentration of amino acids in the hepatic portal vein at point (X) ?



a) Lipase. b) Amylase.
c) Peptidase. d) Pepsin.

8 ✻ In an experiment that illustrates the transport of water, the roots of a dicot plant were put in water coloured with a dye, after several hours, two sections were taken one from the stem and the other from the leaf of the plant. Which of the following parts would be coloured with the dye ?



a) (1) and (3). b) (2) and (4). c) (2) and (3). d) (1) and (4).



9 Which of the following is found in the human blood plasma in the normal cases ?

(a) Fibrin.
(b) Thromboplastin.
(c) Thrombin.
(d) Fibrinogen.

10 Which of the following is(are) required for accomplishing the Krebs cycle in the presence of acetyl groups ?

(a) Glucose.
(b) NADH.
(c) Respiratory enzymes.
(d) ATP molecules.

11 Which of the following food substances **wouldn't** be digested, if it was treated with drops of the pancreatic juice at pH = 8 and 37°C ?

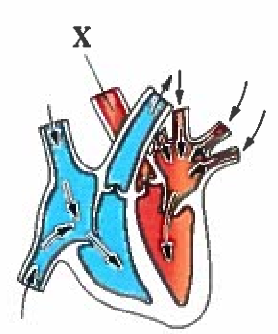
(a) Meat.
(b) Peanut butter.
(c) Bread.
(d) Rice.

12 * "The different food substances like cane sugar and amino acids transfer through the sieve tubes of phloem". Which of the following statements describes this process correctly ?

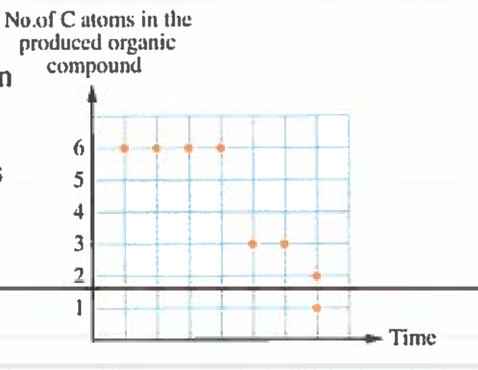
(a) Sugar transfers by active transport in some sieve tubes, while amino acids transfer by diffusion in the other sieve tubes.
(b) Sugar and amino acids transfer together by active transport in the same sieve tube of phloem.
(c) The flow rate of sugar and amino acids increases in two different directions in the same sieve tube of phloem.
(d) The flow rate of sugar and amino acids increases in different directions of different sieve tubes at the same time.

13 In the opposite figure, what is the pressure value in vessel (X) ?

(a) 10 mm Hg
(b) 70 mm Hg
(c) 130 mm Hg
(d) 160 mm Hg

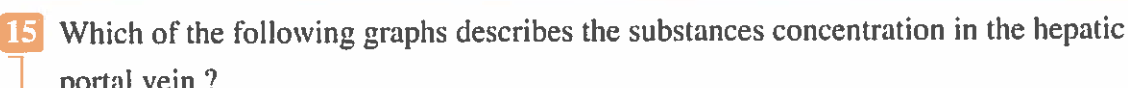


14 ✱ The opposite graph represents the organic compounds which are formed during cellular respiration inside the cell cytoplasm of a living organism in case of O_2 deficiency, which one of the following organisms performs this type of respiration ?

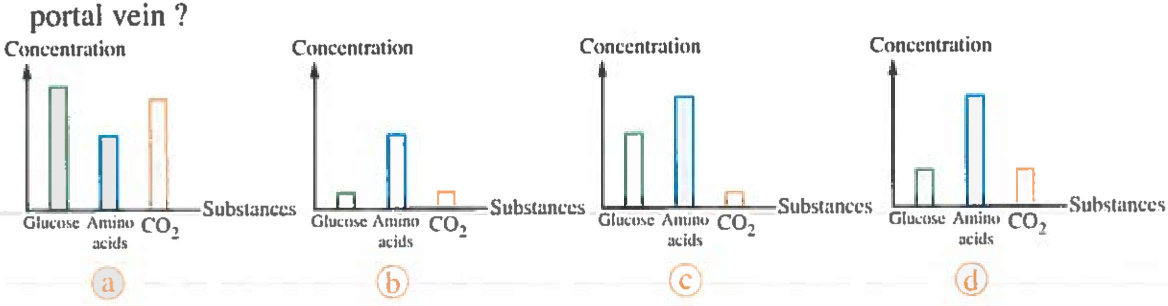


(a) ~~*Paramecium*.~~ (b) ~~Bacteria.~~

(c) *Euglena*. (d) Yeast fungus.



15 Which of the following graphs describes the substances concentration in the hepatic portal vein ?



16 Some soil fungi cause wilting diseases for some crops, whereas they attack the xylem vessels and grow inside them, which of the following vital processes will be affected by these fungi ?

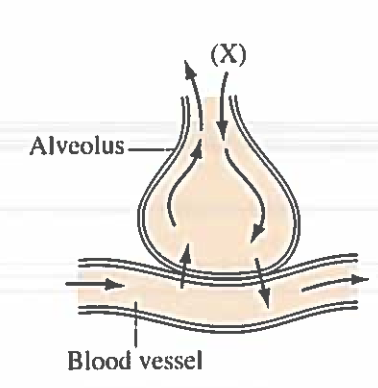
(a) Cohesion force among H_2O molecules.

(b) Adhesion force between H_2O molecules and walls of xylem vessels.

(c) The flow rate of solutes during transmission.

(d) The absorption rate of H_2O through the root hairs.

17 From studying the opposite figure, what is the substance that is formed from the combination of substance (X) with the haemoglobin in the red blood corpuscle in the two lungs ?



(a) Protein.

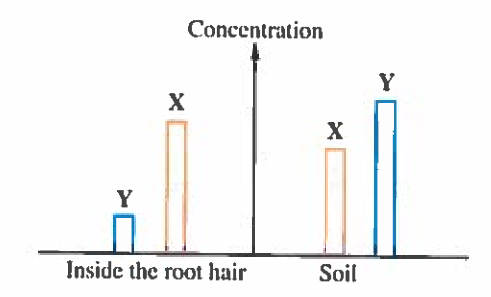
(b) Iron.

(c) Carbo-aminohaemoglobin.

(d) Oxyhaemoglobin.



18 The following graph shows the concentration of ion (X) and ion (Y) for elements needed by a plant in the soil and inside the root hair of this plant :



What are the physical phenomena that lead to transferring (X) and (Y) respectively ?

(a) Active transport and diffusion.

(b) Selective permeability and active transport.

(c) Diffusion and selective permeability.

(d) Selective permeability and diffusion.

19 * What is the number of the produced ATP molecules after the electron transport chain from 10 molecules of pyruvic acid ?

(a) 150 (b) 170

(c) 180 (d) 190

20 What happens if you put a plant cell in a sucrose solution whose concentration is more than the cell osmotic pressure ?

(a) It will swell, due to the entry of H_2O inside its sap vacuole.

(b) It will shrink, due to H_2O exit from its sap vacuole.

(c) It will not be affected.

(d) It will burst.

21 What is the required condition for exiting 6 molecules of CO_2 during the aerobic cellular respiration ?

(a) Glycolysis.

(b) Pyruvic acid oxidation and completing two Krebs cycles.

(c) The occurrence of complete oxidative phosphorylation.

(d) The cell consumes more O_2

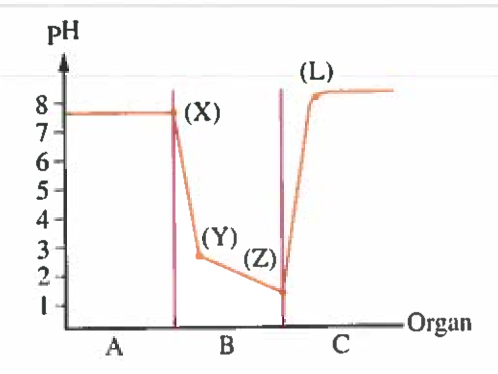
EXAM 1

Answer the following questions (22 : 27) :

22 **Explain :** leaves represent the production lines, while phloem tissue represents the distribution lines in plant.

23 **What is the relation between :** the red blood cells and facilitating the digestion of fats ?

24 **The following graph illustrates three organs in the digestive canal (A), (B) and (C), illustrate the substance which is responsible for the change in pH from :**



(a) Point (X) to point (Y).

(b) Point (Z) to point (L).

25 **Suggest one reason for :** stopping the reactions of the electron transport chain.

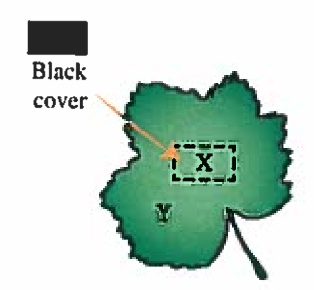


26 **The opposite table illustrates** the relative percentages in the inhaled air, the exhaled air and the residual air in lung (the alveolar air).

	Inhaled air	Exhaled air	Alveolar air
O_2%	21	16	14
CO_2 %	0.03	4	5.5

Explain how the differences occur in these components according to what happens in the two lungs.

27 **In the opposite figure,** a black cover was put on part (X), then the leaf was exposed to light for several hours. **Conclude** what happens if some drops of iodine solution are put on parts (X) and (Y), after removing the black cover.

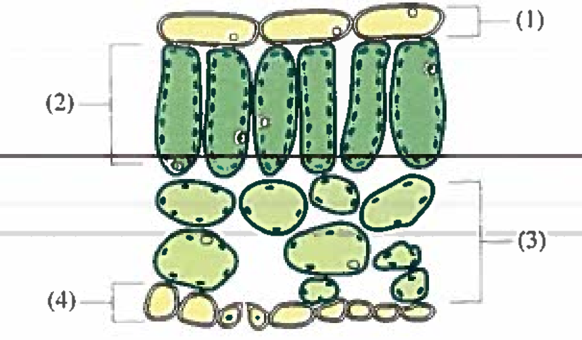


General Exam 2



Choose the correct answer (1 : 21) :

1 The opposite figure illustrates a part of the transverse section in a leaf of a plant, which of the following tissues is the most efficient to perform the photosynthesis process ?



ⓐ (1).　　ⓑ (2).

ⓒ (3).　　ⓓ (4).

2 Which of the following happens in case of the presence or absence of oxygen in the living cell ?

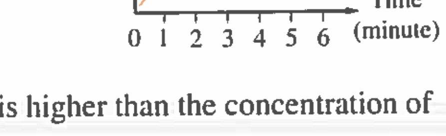
ⓐ Glycolysis.

ⓑ The conversion of pyruvic acid into acetyl coenzyme (A).

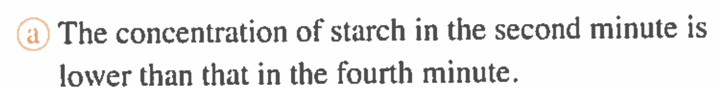
ⓒ Citric acid cycle.

ⓓ Oxidative phosphorylation.

3 * The opposite graph illustrates the activity of amylase enzyme, what can we conclude from this graph ?



ⓐ The concentration of starch in the second minute is lower than that in the fourth minute.



ⓑ The concentration of glucose in the fourth minute is higher than that in the first minute.

ⓒ The concentration of maltose in the second minute is higher than that in the fourth minute.

ⓓ The concentration of maltose in the fourth minute is higher than the concentration of starch.

4 * Which of the following percentages are equal ?

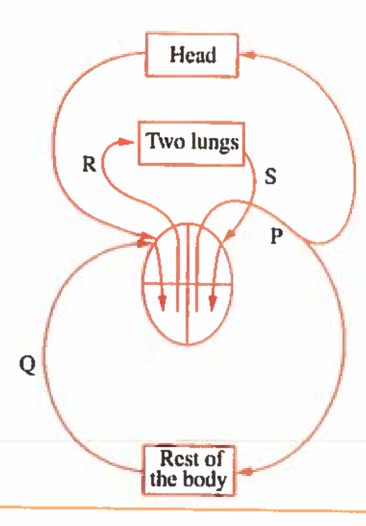
ⓐ The percentage of O_2 in the inhaled air with its percentage in the alveolar air.

ⓑ The percentage of CO_2 in the exhaled air with its percentage in the alveolar air.

ⓒ The percentage of N_2 in the inhaled air with its percentage in the exhaled air.

ⓓ The percentage of H_2O in the inhaled air with its percentage in the exhaled air.

5 The opposite figure represents the heart and the main blood vessels, which of the following blood vessels has the highest blood pressure ?



ⓐ R

ⓑ S

ⓒ P

ⓓ Q

6 How far are these statements "the green plant is autotrophic", "it absorbs water and glucose from the soil" correct ?

ⓐ The two statements are correct and related.

ⓑ The two statements are correct and not related.

ⓒ The first statement is correct and the second statement is wrong.

ⓓ The first statement is wrong and the second statement is correct.

7 ✱ If 30 molecules of NADH are coming out from Krebs cycle to the electron transport chain, what is the number of pyruvic acid molecules which entered into the mitochondria to participate in the reactions ?

ⓐ 5 ⓑ 10

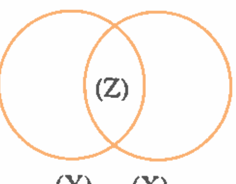
ⓒ 15 ⓓ 20

8 Which of the following elements is/are **not** present in the food of aphid insect, when it is examined ?

ⓐ Amino acids. ⓑ Fatty acids.

ⓒ Sucrose. ⓓ Water.

9 ✱ The opposite figure illustrates two types of the body fluids, if you know that (Y) contains enucleated cells, what do you expect about the components of fluid (Z) ?



ⓐ Plasma and white blood corpuscles.

ⓑ Lymph and plasma.

ⓒ Lymph and white blood corpuscles.

ⓓ Red blood corpuscles and blood platelets.

10 What is the difference between the green plants and the purple sulphur bacteria ?

(a) The type of chlorophyll in each one of them only.

(b) The hydrogen source which is required to reduce CO_2 in each one of them only.

(c) The type of chlorophyll and the source of hydrogen required to reduce CO_2 in each one of them.

(d) Green plants are autotrophic, while purple sulphur bacteria are saprophytes.

11 Which of the following vital processes **doesn't** need ATP ?

(a) Aerobic respiration.

(b) Glycolysis.

(c) Anaerobic respiration.

(d) H_2O splitting in the photosynthesis process.

12 "After eating too much salty popcorn, we feel roughness in the internal side of lips". What is the reason for that ?

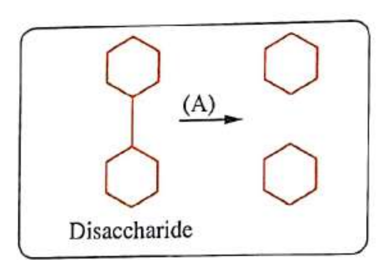
(a) Entry of salt into the lips' cells that leads to their swelling.

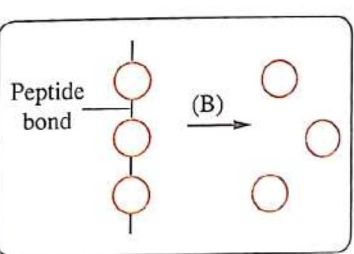
(b) Exit of salt from the lips' cells that leads to their shrinkage.

(c) Entry of water into the lips' cells that leads to their swelling.

(d) Exit of water from the lips' cells that leads to their shrinkage.

13 Study the following diagrams, then answer the following question :





What is the suitable value of pH for the activation of enzymes (A) and (B) together ?

(a) 6 (b) 7 (c) 8 (d) 9

14 What is the blood vessel which contains the highest percentage of fats after digestion and absorption processes accomplishement?

(a) Superior vena cava.

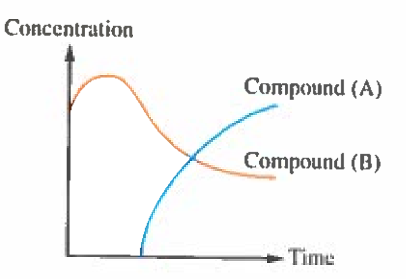
(b) Inferior vena cava.

(c) Hepatic portal vein.

(d) Hepatic vein.

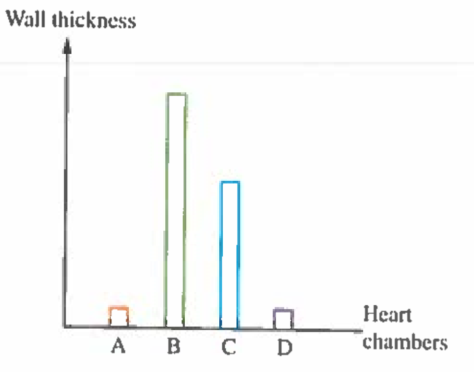
15 The opposite graph represents the concentration of two types of compounds in the thigh muscles, during performing vigorous exercises, which of the following expresses (A) and (B) respectively ?




(a) ADP / Glucose. (b) Lactic acid / Glucose.

(c) Glycogen / ATP (d) Glycogen / Lactic acid.

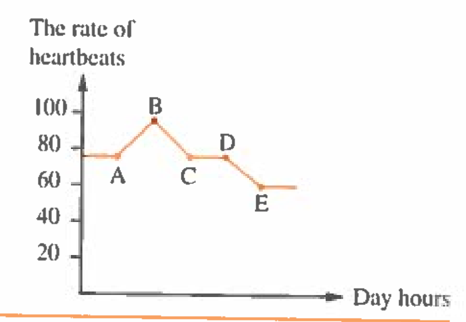
16 Study the opposite graph which shows the difference in the thickness of the heart chambers in human, what is the chamber that is represented by column (B) ?




(a) Right atrium. (b) Left ventricle.

(c) Left atrium. (d) Right ventricle.

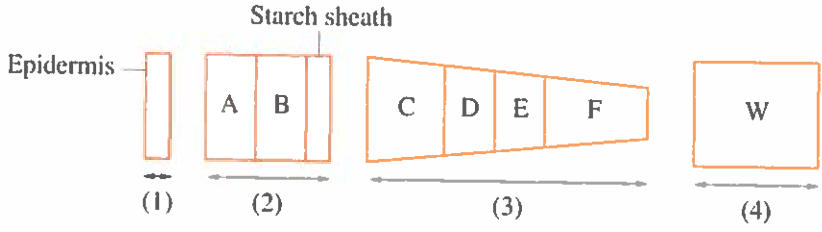
17 Study the opposite graph which shows the heartbeats rate for a person during the day, then determine, what is the interval time that represents performing a physical activity ?




(a) AB (b) DE

(c) BC (d) CD

18 The following diagram shows 4 parts in the stem of a dicot plant arranged from outside to inside, study it then determine :



What is the function which the cells of the tissues (D) and (F) share ?

(a) Aeration. (b) Elasticity.

(c) Sap storage. (d) Sap transfer.

19 The opposite diagram shows some vital processes that occur inside some living organisms, in which of the following organisms do these processes take place ?

Glucose
Production
Production
ATP
Energy
Storage

(a) *Chlorella* alga. (b) Yeast fungus.
(c) *Bilharzia* worms. (d) *Orobanche* plant.

20 Which of the following plants do you expect its leaves epidermis is devoid of cutin ?

(a) Bean. (b) Corn. (c) *Elodea*. (d) Cactus.

21 Which of the following compounds its deficiency affects both the rate of respiration and photosynthesis processes in *Elodea* plant ?

(a) ATP (b) FAD (c) NAD^+ (d) NADP

Answer the following questions (22 : 27) :

22 **From the opposite figure, deduce** what happens to the solution in tube (X).

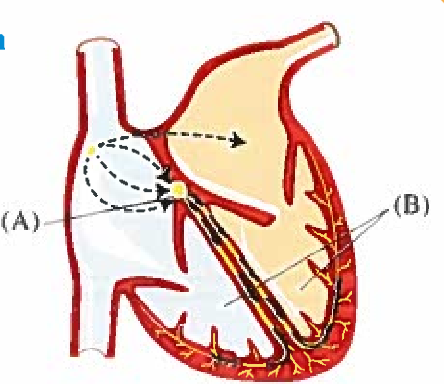
Limewater
Boiled bean seeds
(X)
(Y)

23 **Explain :** the transfer of water in plant is faster at noon and slower at night.

24 **What happens if :** the respiration of the root tissues stops ?



25 **The opposite figure illustrates a longitudinal section in the human heart and the arrows represent the direct movement of the electric pulse which makes the muscle start to contract.**



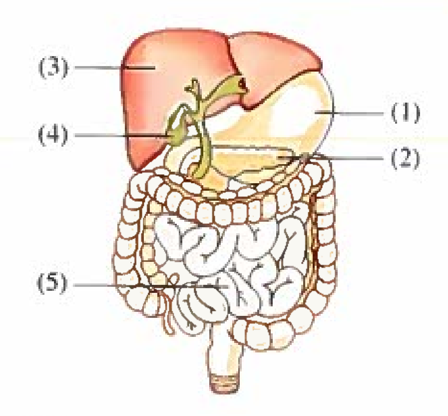
Illustrate :

(a) The reason for the delaying in the passage of the electric pulse that occurs at point (A).

(b) The importance of (B) contraction from the base.

26 "The aerobic respiration may occur after the anaerobic respiration".
How far the statement is correct ? With explanation.

27 **The opposite figure illustrates a part of the human digestive system, write the number and the name of the organ :**



(a) That is responsible for the adjustment of the pH value in organ no. (5).

(b) That contains the highest concentration of hydrogen ions.



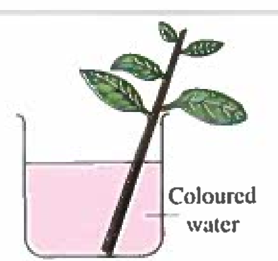
General Exam 3

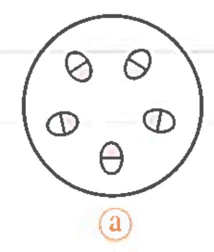
Choose the correct answer (1 : 21) :

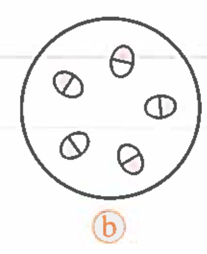
1 In which of the following blood vessels the highest concentration of amino acids is found after eating a meal rich in proteins ?

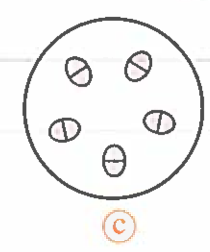
(a) Hepatic vein.
(b) Hepatic portal vein.
(c) Inferior vena cava.
(d) Superior vena cava.

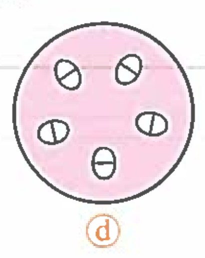
2 ✱ From the opposite figure, which of the following figures represents a transverse section in the stem of a dicot plant ?




(a)


(b)


(c)


(d)

3 What happens when the number of the red blood corpuscles in an adult person reaches 3 million cells/mm^3 of blood ?

(a) The blood red colour intensity remains constant.
(b) The haemoglobin level increases in blood.
(c) The iron level increases in blood.
(d) The iron and haemoglobin level decreases in blood.

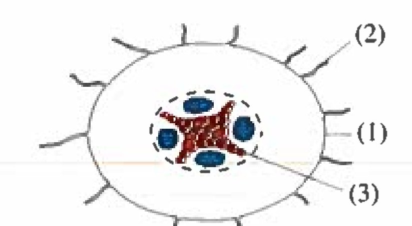
4 ✱ Which of the following is <u>not</u> related to the increase in the rates of elements diffusion against the concentration gradient ?

(a) The increase in the active transport.
(b) The plant absorption for more phosphorus.
(c) The absorption of macro-nutrients only.
(d) The increase in the respiration rates.

5 * Which of the following is synchronized with the relaxation of the walls of the right atrium ?

ⓐ Opening of mitral valve.
ⓑ Closure of pulmonary valve.
ⓒ Opening of tricuspid valve.
ⓓ Opening of aortic valve.

6 The opposite figure illustrates a transverse section in the plant root, which of the following parts absorb(s) water and salts ions mainly ?



ⓐ (1).
ⓑ (2).
ⓒ (1) and (2).
ⓓ (3).

7 Which of the following helps in absorbing oxygen rapidly from the blood that is present in the two lungs ?

ⓐ The air that enters in the two lungs contains a lower amount of O_2 than the air comes out from them.
ⓑ The wall of alveolus is thick and has a large surface area.
ⓒ The wall of alveolus is thin and has a large surface area.
ⓓ The concentration of O_2 in the blood is higher than its concentration in the alveolus.

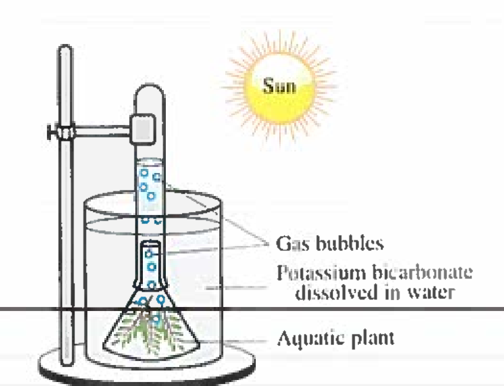
8 Which of the following statements **doesn't** agree with the cardiac circulation ?

ⓐ When the two ventricles contract, the valves between atria and ventricles close.
ⓑ When the two ventricles relax, the semi-lunar valves close.
ⓒ When the two atria contract, the semi-lunar valves open.
ⓓ When the two atria contract, the valves between atria and ventricles open.

9 * What is the difference between the fermentation in yeast fungus and the fermentation in a fatigued muscle fiber ?

ⓐ The difference in the released energy amount from one molecule of glucose.
ⓑ Releasing less amount of CO_2
ⓒ The breaking down of a lower number of chemical bonds.
ⓓ The fats and proteins aren't used as a source of energy.

10 From the opposite figure, what is the evolved gas from this experiment ?



(a) Carbon dioxide.

(b) Hydrogen.

(c) Nitrogen.

(d) Oxygen.

11 Which of the following statements describes the enzymes which are present in the raw fruits and vegetables ?

(a) The plant enzymes don't work inside the plant.

(b) The enzymes change their substrates inside the human body.

(c) The enzymes that are present in them become inactive by heating and cooking.

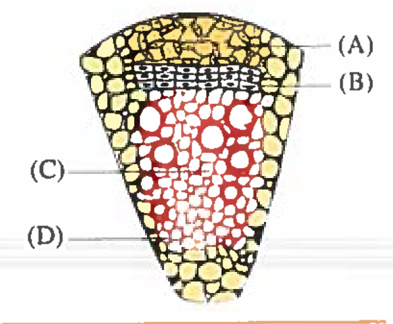
(d) The enzymes increase the activation energy.

12 A child ate a meal containing wheat and milk, what is the suitable pH value for the action of several enzymes together to digest this meal ?

(a) 5 (b) 6

(c) 7 (d) 8

13 Study the opposite figure which shows a part of T.S. in a dicot plant stem, which of the following expresses the cells originated from undifferentiated cells ?



(a) (A). (b) (B).

(c) (C). (d) (D).

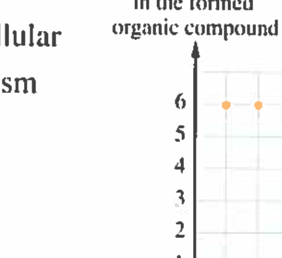
14 From which of the following are the walls of the blood vessels ends that spread among the cells of liver tissues formed ?

(a) Epithelial layer. (b) Epithelial and muscular layers.

(c) Muscular and connective layers. (d) Muscular layer.



15 ✱ Study the opposite graph which describes the organic compounds that are formed during cellular respiration inside the cytoplasm of a living organism cell in case of O_2 deficiency, what is the living organism that performs this type of respiration ?



ⓐ *Paramicum*. ⓑ Bacteria.

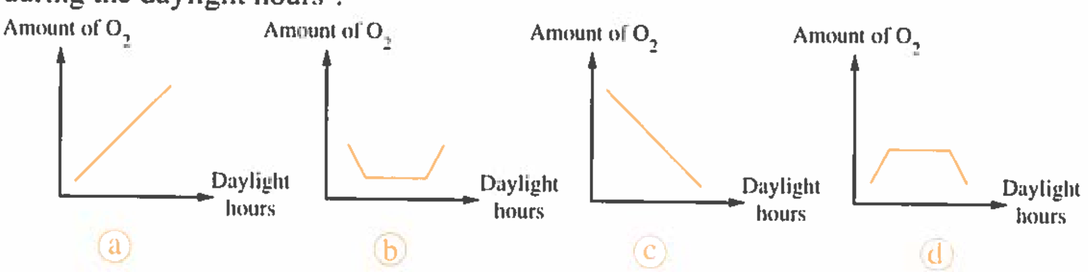
ⓒ *Amoeba*. ⓓ Yeast fungus.

16 Which body organ can form and destroy two types of blood components ?

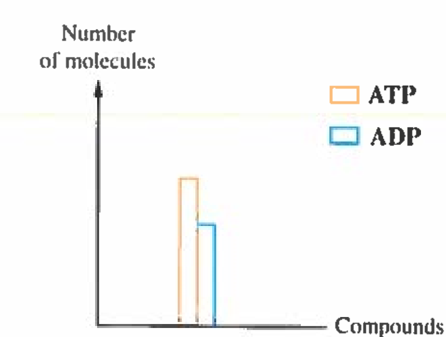
ⓐ Heart. ⓑ Liver.

ⓒ Pancreas. ⓓ Spleen.

17 Which of the following graphs describes the evolved O_2 amount from a plant during the daylight hours ?



18 ✱ The opposite graph shows some of the photosynthesis process products, which of the following occurs during this stage ?



ⓐ The formation of H_2O molecules.

ⓑ The oxidation of $NADPH_2$

ⓒ The release of O_2

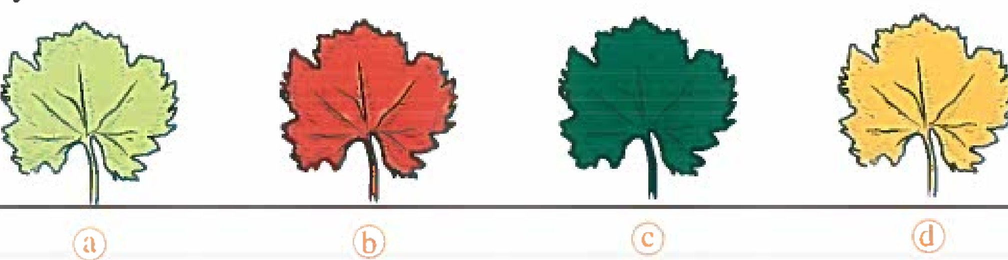
ⓓ The reduction of CO_2

19 In the presence of O_2 after performing a running race, the body works on ....

ⓐ oxidizing lactic acid. ⓑ oxidizing NADH

ⓒ reducing pyruvic acid. ⓓ ATP molecules decomposition.

20 Which of the following plant leaves produces a greater amount of oxygen at daytime ?



(a) (b) (c) (d)

21 Study the following diagram :



Which of the following represents (X) and (Y) respectively ?

(a) CO_2 and O_2

(b) O_2 and CO_2

(c) Water vapour and O_2

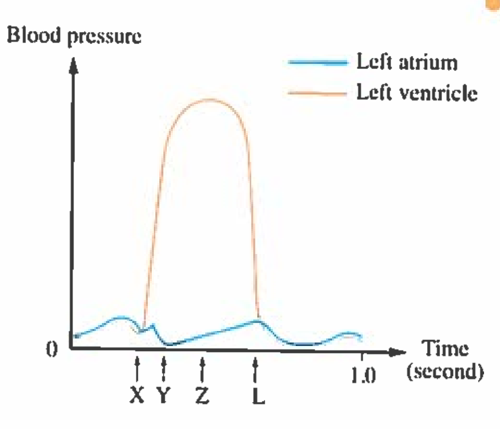
(d) Water vapour and CO_2

Answer the following questions (22 : 27) :

22 **What is the similarity between :** glycolysis and Krebs cycle ?

23 **What is the difference between :** the epidermis in each of the root and stem ?

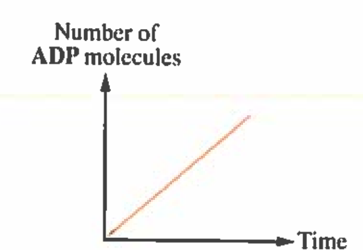
24 **The opposite graph** illustrates the changes in the blood pressure for each of the left atrium and left ventricle during the heart beating, **determine** the time at which the mitral valve opens.



25 **Explain :** the entrance of oxygen or air in the stem of a herbaceous plant is different from the woody stem.

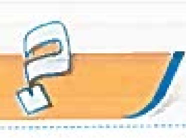
26 "The role of enzymes is restricted on the digestion of food substances only".
How far the statement is correct ? With explanation.

27 **The opposite figure** illustrates the change in the number of ADP molecules in the cell over time, is the mentioned cell in an active state or not ? **Explain.**



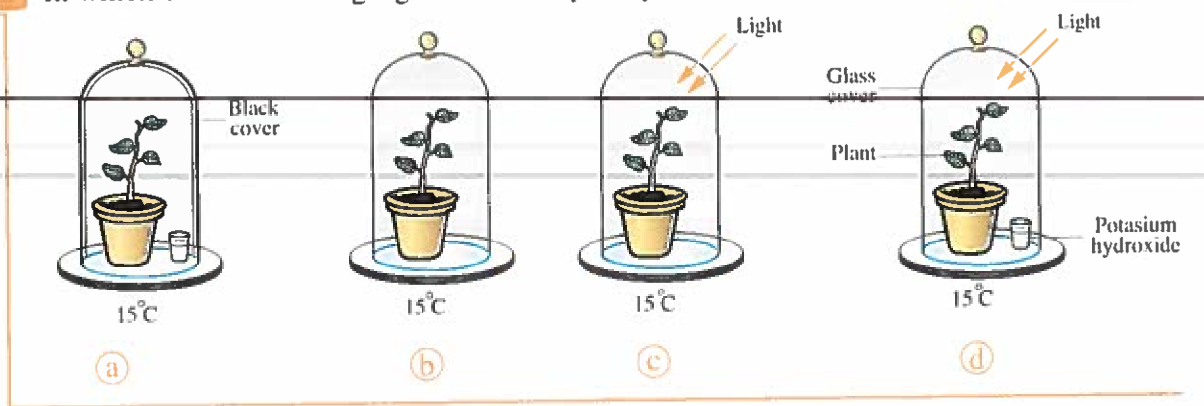


General Exam 4



Choose the correct answer (1 : 21) :

1 In which of the following figures can the plant perform the photosynthesis process ?



2 Which of the following **doesn't** agree with glycolysis and the reactions which occur in the grana of the chloroplast ?

(a) Both of them need energy.

(b) ATP molecules are released from both of them.

(c) Their occurrence is associated with the presence of coenzymes.

(d) 3-carbon compound is formed in each one of them.

3 After performing a muscular effort, which of the following blood vessels carries the lowest concentration of CO_2 ?

(a) Hepatic vein.

(b) Pulmonary artery.

(c) Pulmonary vein.

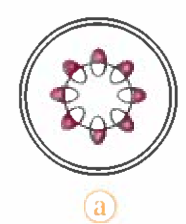
(d) Vena cava.

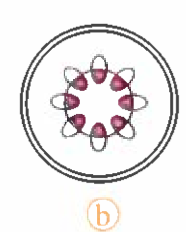
4 * What is the number of CO_2 molecules which is resulted from Krebs cycle when a molecule of maltose is completely oxidized ?

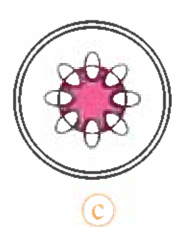
(a) 2 (b) 4 (c) 6 (d) 8



5 A plant was put in water containing red dye for 24 hours, then it was removed and several sections were taken from the plant stem, which of the following figures illustrates that ?

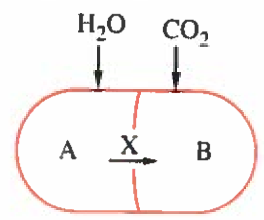

(a)


(b)


(c)


(d)

6 From the opposite figure, that shows what happens inside the green plastid which of the following represents (X) ?



(a) ATP and PGAL
(b) ADP and CO_2
(c) H_2O and NADP
(d) $NADPH_2$ and ATP

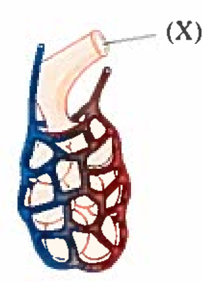
7 Which of the following is found in the pulmonary artery with the highest percentage ?

(a) Oxyhaemoglobin.
(b) Carbo-aminohaemoglobin.
(c) Haemoglobin.
(d) Haemoglobin and oxyhaemoglobin.

8 ✱ In which of the following stages the least amount of ATP molecules is released directly ?

(a) Glycolysis.
(b) Oxidation of pyruvic acid into acetyl group.
(c) One Krebs cycle.
(d) Electron transport chain.

9 In the opposite figure, what does part (X) represent ?



(a) A main branch from the trachea.
(b) A branch from a blood vessel.
(c) An alveolus.
(d) A bronchiole.

10 What is the organ which secretes digestive juices for all types of food ?

ⓐ Stomach. ⓑ Liver. ⓒ Pancreas. ⓓ Duodenum.

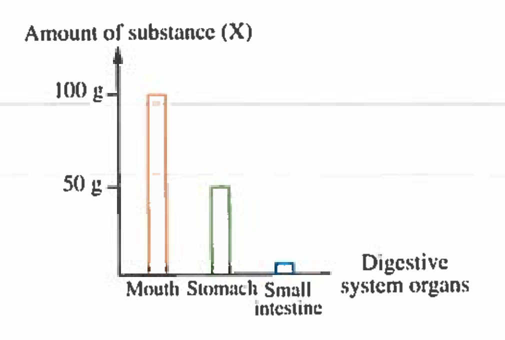
11 What is(are) the substance(s) that form(s) the greatest portion of lymph ?

ⓐ Water. ⓑ Fats.
ⓒ Proteins. ⓓ Monosaccharides.

12 What is the ratio between the amount of energy produced from ATP molecule and that produced from NADH molecule ?

ⓐ 1 : 3 ⓑ 2 : 1 ⓒ 1 : 2 ⓓ 3 : 1

13 ✱ Study the opposite graph which shows the route of (100 g) of food substance (X) through different digestive organs after more than 1 hour of its ingestion. What is the form of (X) when it is transferred through the villi of small intestine ?



ⓐ Glycerol. ⓑ Monosaccharides.
ⓒ Fatty acids. ⓓ Amino acids.

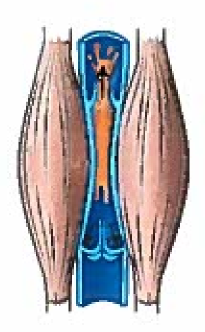
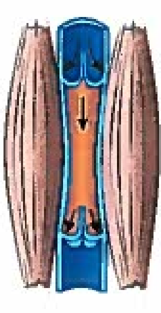
14 Potato slices with equal lengths were put in serial concentrations of sucrose sugar for 30 minutes, their lengths were measured before and after treating, the following graph shows the ratio between the length before and after treating and the sugar solution concentration. Which of the following shows the change in the length of the potato slices and the pressure of fullness with water, with increasing the concentration of sugar solution ?

The length before / The length after (cm)
1.4, 1.2, 1.0, 0.8, 0.6, 0.4
Concentration (%)
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

	The ratio between the length before and after treating	Pressure of fullness with H_2O
ⓐ	Increases	Increases
ⓑ	Increases	Decreases
ⓒ	Decreases	Decreases
ⓓ	Decreases	Increases



15 From studying the two opposite figures, what is the role of the muscles that surround the blood vessels ?

(a) Opening the valve when the muscles contract.
(b) Opening the valve when the muscles relax.
(c) The closure of the valve when a muscle contracts and the opposite muscle relaxes.
(d) Opening of the valve when a muscle contracts and the opposite muscle relaxes.

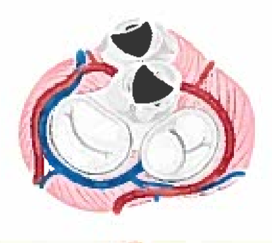
16 Study the following pathways :

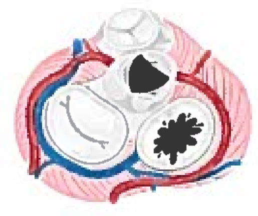
- Alveolus ⟶ O_2 ⟶ Blood capillaries.
- Small intestine ⟶ Amino acids ⟶ Blood capillaries.
- Atmospheric air ⟶ CO_2 ⟶ Plant cells.

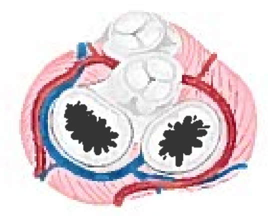
What is the common mechanism in transferring the substances in the previous pathways ?

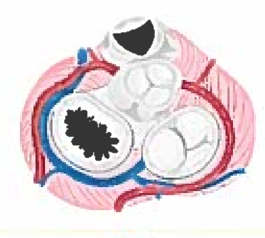
(a) Active transport. (b) Osmosis. (c) Diffusion. (d) Imbibition.

17 The following figures show the upper view of the heart valves, which of them describes what happens in the heart during the measurement of blood pressure and represented by the lower number ?


(a)


(b)


(c)


(d)

18 Which of the following substances <u>**isn't**</u> formed inside the liver ?

(a) Bile juice. (b) Heparin.
(c) Glycogen. (d) Lipase enzyme.

19 If the energy produced during the oxidation of a glucose molecule aerobically equals 2880 KJ. What is the expected amount of energy produced from a glucose molecule in a skeletal muscle during the anaerobic respiration ?

(a) 75 KJ (b) 150 KJ (c) 300 KJ (d) 450 KJ

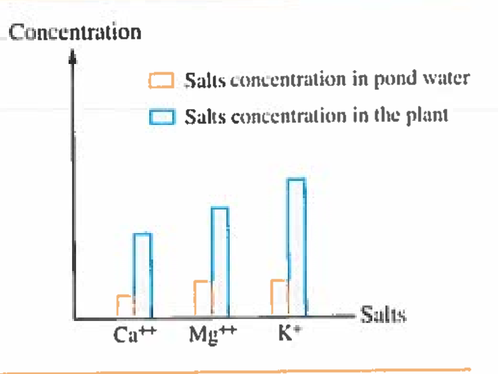
20 Study the following table :

Substance	Concentration in villus	Concentration in transport vessels
Na^+	155 mg / 100 mL	15 mg / 100 mL
Glycine	0.1%	0.02%
H_2O	75%	70%
Cl^-	1.01 mg / 100 mL	1.5 mg / 100 mL
Fat droplets	0.35%	0.33%

Which of the following substances will be transferred to the transport vessels by the same phenomenon ?

(a) Na^+ and Cl^-
(b) H_2O and Cl^-
(c) Cl^- and glycine.
(d) Glycine and fat droplets.

21 From the opposite graph, by which of the following mechanisms the plant absorbs salts ?



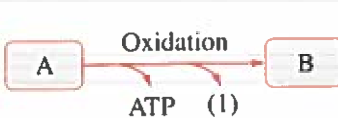
(a) Diffusion.
(b) Permeability.
(c) Active transport and permeability.
(d) Cation or anion exchange.

Answer the following questions (22 : 27) :

22 **Write the scientific term :** "Non-living plant structures, where the shape of their inner surface changes from a plant to another".

....

23 **From the opposite diagram,** if you know that (A) and (B) are intermediate compounds which are formed through one of the cellular respiration stages inside the mitochondria and each one of them consists of the same number of carbon atoms, what is the name of product no. (1) ?



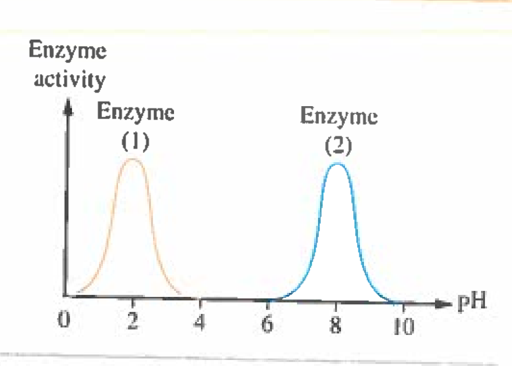
....

24 **Explain :** glycolysis process needs energy.

25 If you know that the saline solution which is given through a venous injection, its concentration is 0.9%, **deduce** what happens to the red blood corpuscles when the concentration of the saline solution is 1% or 0.5 %. **Explain your answer.**

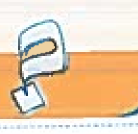
26 "The blood flow factors differ in arteries from veins".
How far the statement is correct ? With explanation.

27 **The opposite graph** illustrates the activity of two enzymes that affect the same food substance, **deduce** the name of the two enzymes (1) and (2).



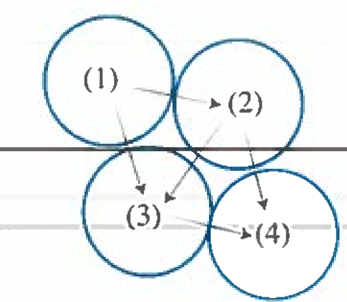
General Exam 5





Choose the correct answer (1 : 21) :

1 * The opposite figure represents the movement of water transfer by osmosis phenomenon among four adjacent plant cells, which of the following cells has the highest concentration of salts before water transferring ?



(a) (1).
(b) (2).
(c) (3).
(d) (4).

2 Which of the following **doesn't** agree with the chlorophyll function in the green plants ?

(a) The conversion of light energy into stored chemical energy in the food molecules.
(b) The absorption of the light energy that is required to perform the photosynthesis process.
(c) The storage of the kinetic energy of light as a chemical potential energy.
(d) The storage of the raw materials that are required to perform the photosynthesis process.

3 Which of the following **doesn't** agree with the occurrence of anaerobic respiration in the muscle ?

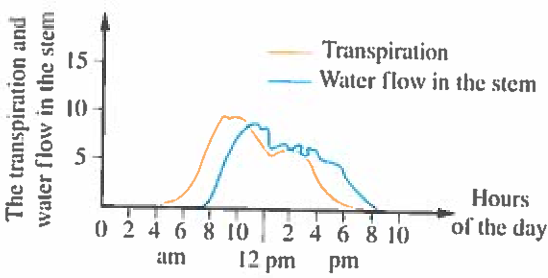
(a) The increase of lactic acid in the muscle.
(b) The depletion of oxygen in blood that reaches the muscle.
(c) The production of a large amount of NADH molecules.
(d) The muscle fatigue.

4 In which of the following cases the blood pressure value in human is the least ?

(a) The contraction of left ventricle.
(b) The relaxation of right atrium.
(c) The closure of bicuspid valve.
(d) The closure of semi-lunar valves.



5 ✱ What do you conclude from your study to the opposite graph ?



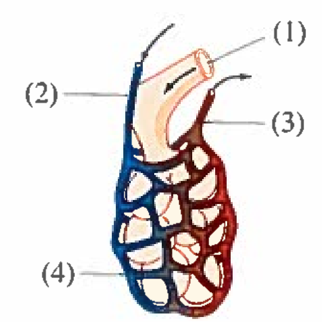
ⓐ The transpiration rate is constant all the day.

ⓑ There is no relation between the water flow in the stem and the transpiration rate.

ⓒ The highest flow of water in the stem is delayed than the highest transpiration rate.

ⓓ The transpiration rate can't reach zero.

6 From the opposite figure, which of the following structures contains the highest concentration of O_2 gas ?




ⓐ (1).


ⓑ (2).

ⓒ (3).

ⓓ (4).

7 Which of the following statements is applied to the digestive juices that are secreted by liver and pancreas ?

ⓐ They digest the same food substances.

ⓑ They work at the same pH value.

ⓒ Their enzymes need activators to work.

ⓓ The same products of digestion are produced by their action.

8 How is the equation of this reaction ($C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38\ ATP$) affected, when the number of coenzymes decreases in mitochondria ?

ⓐ The glucose will be formed again.

ⓑ Water will not be from the reaction products.

ⓒ The rate of ATP molecules production will be affected.

ⓓ The number of CO_2 molecules will decrease.

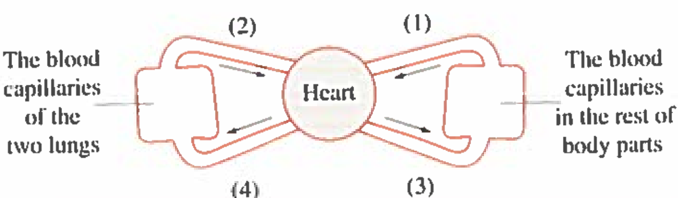
9 * In the following figure, which of the blood vessels carry oxygenated blood ?

ⓐ (1) & (2).

ⓑ (1) & (3).

ⓒ (2) & (3).

ⓓ (2) & (4).



10 What happens during the passage of the food bolus in the oesophagus ?

ⓐ The proteins digestion starts.

ⓑ The fats digestion starts.

ⓒ The carbohydrates digestion continues.

ⓓ The digestion process stops.

11 What should be present for the occurrence of the anaerobic cellular respiration ?

ⓐ O_2

ⓑ CO_2

ⓒ Specific enzymes.

ⓓ FAD

12 When will the root pressure stop ?

ⓐ When the water comes out from the stem by exudation.

ⓑ When the water transfers to root cells by the imbibition phenomenon.

ⓒ When it increases more than 2 atmospheric pressure (atm).

ⓓ When it becomes equal to the pressure of water column in xylem vessels.

13 Which of the following may occur if suberin precipitated on the double membrane of chloroplasts ?

ⓐ Difficulty in the light passage.

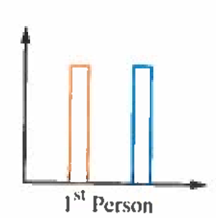
ⓑ Chlorophyll won't be formed.

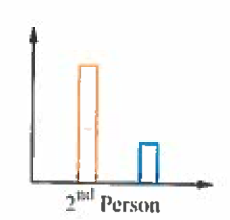
ⓒ High speed of O_2 formation.

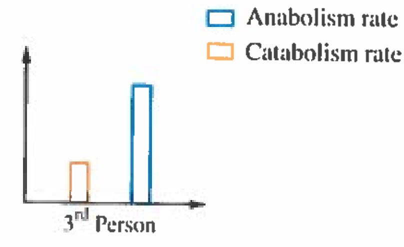
ⓓ Water passes easily.



14 The following graphs describe the relation between the rate of anabolism and catabolism in 3 people differ in the age-stage :







Which of the following represents the arrangement of the 3 people from the first to the third ?

- (a) Childhood - Youth - Elderhood.
- (b) Youth - Childhood - Elderhood.
- (c) Elderhood - Childhood - Youth.
- (d) Youth - Elderhood - Childhood.

15 The living cells keep the internal concentration of ions which differs from the external concentration, what is the reason for continuing the concentration difference ?

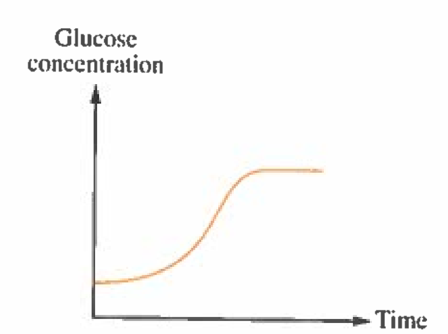
- (a) Cells' walls.
- (b) Cells' vacuoles.
- (c) Cells' membranes.
- (d) Plastids.

16 Which of the following **doesn't** happen during the dark reactions ?

- (a) (C) fixation.
- (b) $NADPH_2$ oxidation.
- (c) Oxidative phosphorylation.
- (d) ATP consumption.

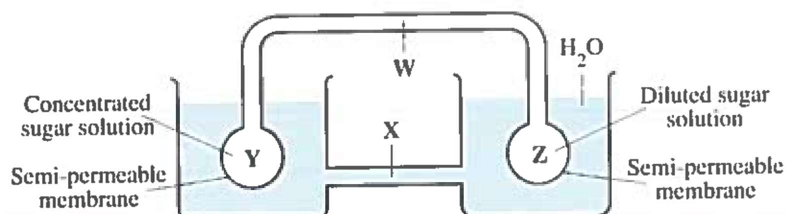
17 What is the blood vessel which is represented by the curve in the opposite graph after eating a meal rich in carbohydrates ?





- (a) Pulmonary artery.
- (b) Hepatic portal vein.
- (c) Hepatic vein.
- (d) Hepatic artery.

18 * The following figure shows a model for the transport process of organic substances in the plant :



Which of the following choices describes the structures from (Y) : (Z) and the correct direction for the transport process through structure (W) ?

	Phloem	Xylem	Roots	Leaves	Transport direction
(a)	W	X	Y	Z	Z ⟶ Y
(b)	W	X	Z	Y	Y ⟶ Z
(c)	X	W	Y	Z	Y ⟶ Z
(d)	X	W	Z	Y	Z ⟶ Y

19 When we put the RBCs in a salt solution of unknown concentration for a period of time, the cells shrink, what do you conclude from this ?

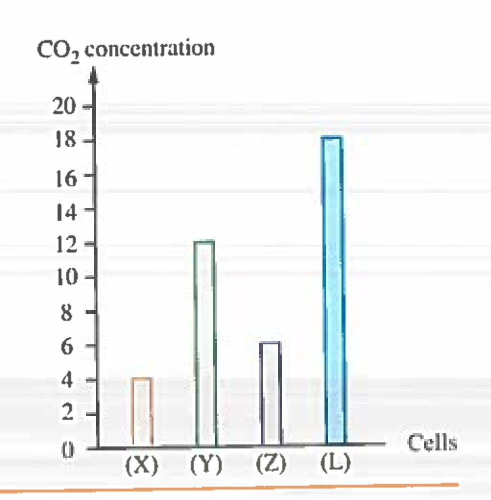
(a) The concentration of salts in the solution is less than their concentration in the blood cells.

(b) The concentration of salts in the solution is more than their concentration in the blood cells.

(c) The concentration of salts in the solution is equal to their concentration in the blood cells.

(d) There is no relation between the salts concentration, and the cells shrinkage .

20 * The opposite graph represents the amount of released CO_2 during the aerobic respiration process, in which cell are the three glucose molecules oxidized completely ?




(a) (X).

(b) (Y).

(c) (Z).

(d) (L).

21 Which of the following enter(s) in the structure of ATP molecule made by the plant in addition to carbon, hydrogen and oxygen ?

(a) A macro-nutrient and a micro-nutrient.

(b) Two macro-nutrients.

(c) A macro-nutrient.

(d) Two micro-nutrients.

Answer the following questions (22 : 27) :

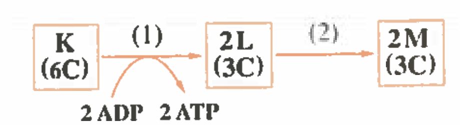
22 **Explain :** ptyalin enzyme is secreted in an active form, while pepsin enzyme is secreted in an inactive form.

23 **What happens in case of :** the deposition of cutin on the external walls of the root hairs ?

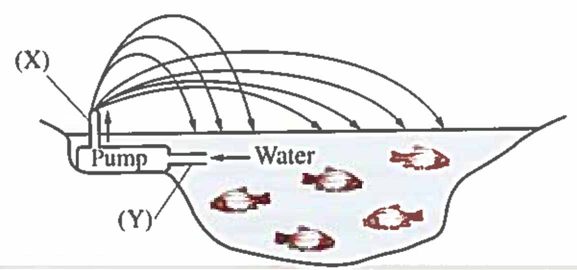
24 **Calculate :** the number of ATP molecules which is resulted from the oxidation of 10 glucose molecules inside a seed of a dicot plant at the beginning of the germination process.

25 "The speed of the food substances transport in the plant depends on some external factors". **How far the statement is correct ? With explanation.**

26 **The opposite diagram** illustrates a conversion in a muscular cell in the body, where the concentration of compound (M) increases during the muscular fatigue, **what** is the purpose of step no. (2) ?



27 **In the opposite figure,** the lake is supplied with the atmospheric oxygen through an external source to reach the fish, if you know that the work of this pump is similar to the work of the heart in the human blood circulation. **What** are the blood vessels that are similar to the work of each of (X) and (Y) ?



General Exam 6

Choose the correct answer (1 : 21) :

1 Which of the following elements its absence **doesn't** affect the photosynthesis process ?

ⓐ Iron.
ⓑ Phosphorus.
ⓒ Magnesium.
ⓓ Calcium.

2 What is the similarity between the lymphatic system and the circulatory system ?

ⓐ The presence of nodes that work on getting rid of pathogens.
ⓑ The presence of a network of arteries.
ⓒ The presence of a network of blood capillaries.
ⓓ Each of them has an immunization function.

3 Which of the following tissues has the ability to divide mitotically in the plant ?

ⓐ Xylem.
ⓑ Phloem.
ⓒ Palisade tissue.
ⓓ Cambium.

4 * In the opposite diagram, what do the two processes (1) and (2) represent ?

A (12C) —(1)→ B —(2)→ D + E + 38 ATP

ⓐ (1) is hydrolysis and (2) is catabolism.
ⓑ (1) is anabolism and (2) is hydrolysis.
ⓒ (1) is anabolism and (2) is catabolism.
ⓓ (1) is catabolism and (2) is anabolism.

5 What is the importance of water in photosynthesis process ?

ⓐ A solvent for carbon dioxide gas.
ⓑ A source for the evolved oxygen.
ⓒ A source for hydrogen that is required for the reduction process.
ⓓ A receiver for light energy.

6 When CO_2 is consumed in photosynthesis process, which of the following illustrates the path of CO_2 diffusion in the leaf after entering through the stomata ?

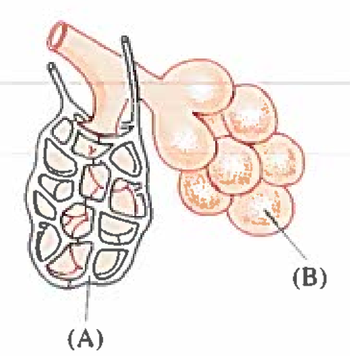
ⓐ Cell wall → Plasma membrane → Intercellular spaces → Cytoplasm → Plastid's membrane.

ⓑ Intercellular spaces → Cell wall → Plasma membrane → Cytoplasm → Plastid's membrane.

ⓒ Intercellular spaces → Plasma membrane → Cell wall → Plastid's membrane → Cytoplasm.

ⓓ Intercellular spaces → Cytoplasm → Plasma membrane → Cell wall → Plastid's membrane.

7 In the opposite figure, structure (B) is surrounded by a network of structures (A) to transfer .... easily.



ⓐ O_2 from (A) to (B)

ⓑ CO_2 from (B) to (A)

ⓒ H_2O from (B) to (A)

ⓓ O_2 from (B) to (A)

8 ✻ How far are these statements "the lining of small intestine contains villi and the lining of large intestine contains convolutions", "both play an important role in the absorption process" correct ?

ⓐ The two statements are correct.

ⓑ The two statements are wrong.

ⓒ The first statement is correct and the second statement is wrong.

ⓓ The first statement is wrong and the second statement is correct.

9 ✻ If the blood pressure value is 110 / 70 mm Hg, which of the following is synchronized with the measurement of number 110 ?

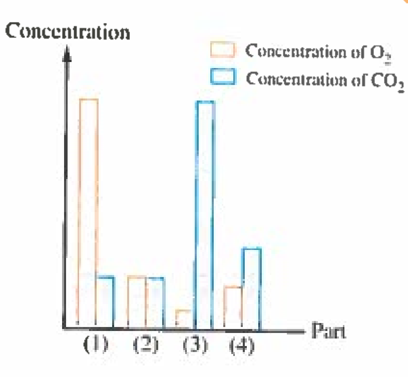
ⓐ The relaxation of ventricles.

ⓑ The contraction of atria.

ⓒ The opening of the valves with flaps.

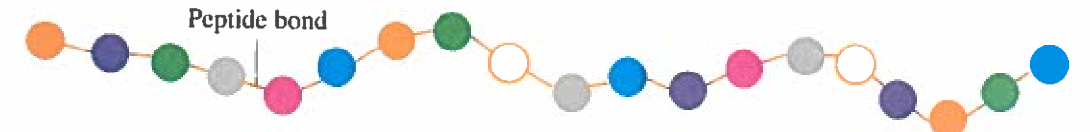
ⓓ The opening of semi-lunar valves.

10  The opposite graph represents the concentration of CO_2 and O_2 gases in blood in different body parts, which of the following represents the blood flow through aorta ?



(a) (1).
(b) (2).
(c) (3).
(d) (4).

11 Study the following figure, then determine :



Which of the following ends the digestion of this compound completely ?

(a) Amylase in duodenum.
(b) Pepsin in stomach.
(c) Trypsin in small intestine.
(d) Peptidase in small intestine.

12 Which of the following substances **can't** be translocated through the phloem and xylem tissues ?

(a) Amino acids.
(b) Sucrose.
(c) Starch.
(d) H_2O

13 What is the similarity between the pulmonary artery and the limbs' veins ?

(a) Both of them contain oxygenated blood.
(b) Both of them contain deoxygenated blood.
(c) Both of them have the same blood pressure.
(d) (b) and (c) together.

14 The following table shows the nutrients that are found in a piece of candy, which one of them **wouldn't** be digested ?

Sample	Nutrient	Amount (g)
(a)	Fats	3
(b)	Glucose	3
(c)	Protein	2
(d)	Starch	6

15 Which of the following phenomena work on transferring the solutes from and to the cell of filamentous-shaped alga ?

ⓐ Diffusion and imbibition.
ⓑ Diffusion and active transport.
ⓒ Imbibition and active transport.
ⓓ Diffusion, osmosis and active transport.

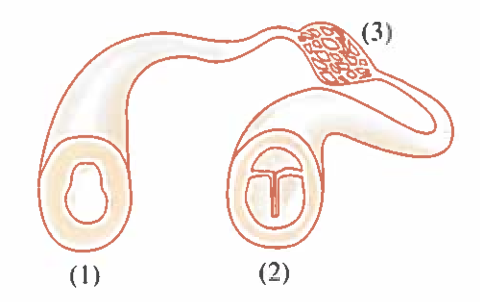
16 Which of the following is accompanied by the formation of glucose 6-phosphate ?

ⓐ Energy production.
ⓑ Energy consumption.
ⓒ CO_2 production.
ⓓ O_2 consumption.

17 ✱ What is the result of absence of the pits from xylem vessels in a plant leaf ?

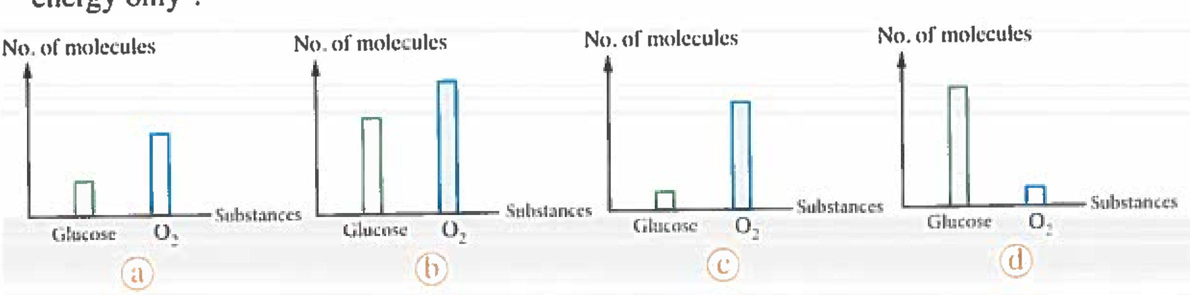
ⓐ Increasing in the salts and H_2O transport to the palisade cells.
ⓑ Stopping the light and dark reactions.
ⓒ Stopping the transport of sucrose and amino acids.
ⓓ Increasing the dark reactions rate.

18 In the opposite figure, what do the blood vessels from (1) : (3) represent respectively ?



ⓐ Vein / Artery / Blood capillaries.
ⓑ Artery / Blood capillaries / Vein.
ⓒ Blood capillaries / Artery / Vein.
ⓓ Artery / Vein / Blood capillaries.

19 ✱ Which of the following graphs represents the fetus need for glucose and O_2 to produce energy only ?

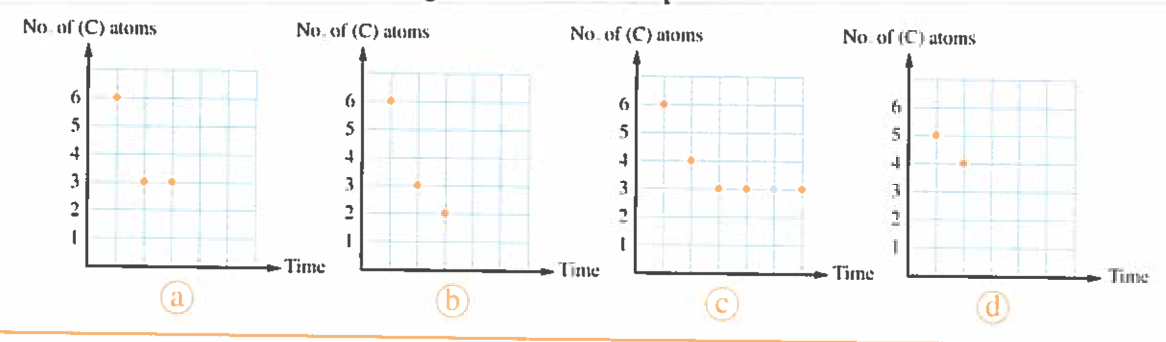


20 What is the reason for the decrease in the plant absorption of salts when the soil is soaked with water ?

(a) Decreasing salts in the soil.
(b) Lack of O_2 in the soil.
(c) Increasing O_2 in the soil.
(d) Increasing in the production of ATP in the root cells.

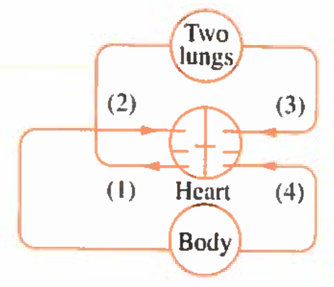
21 ✻ Which of the following graphs represents the reactions that happen to a glucose molecule in a muscle cell during the anaerobic respiration ?



Answer the following questions (22 : 27) :

22 **Explain :** the root hairs are characterized by high osmotic pressures in the salty and desert soils.

23 **The opposite diagram** represents the blood circulation in human, which contains an arrow with wrong direction. **Determine** its name.

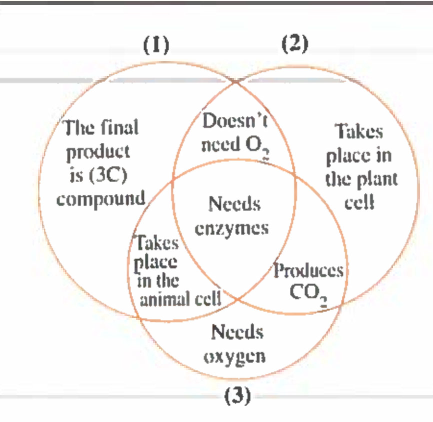


24 **Compare between :** the oxidation process for a piece of sugar in air and its oxidation inside a cell of a living organism's body.

25 "The vascular bundle is similar in each of the stem and leaf of the plant".

How far the statement is correct ? With explanation.

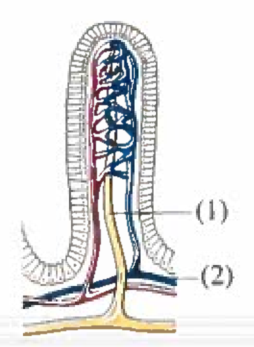
26 **The opposite figure illustrates some vital processes that occur in the cells of living organisms, examine it, then answer :**



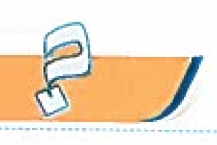
(a) **How many** ATP molecules are produced from the complete oxidation of one molecule of glucose in process no. (3) ?

(b) **Arrange** the processes from (1) : (3) descendingly, according to their energy production.

27 **From the opposite figure, determine** by arrows a simple pathway for the absorbed food substances through the two vessels no. (1) and (2), till reaching the heart.

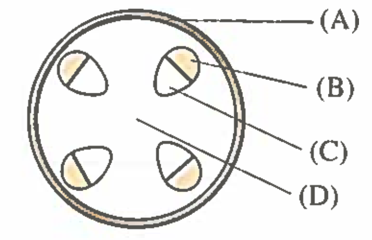


General Exam 7

Choose the correct answer (1 : 21) :

1 The opposite figure illustrates a diagrammatic section in the stem of a dicot plant, in which of the following tissues does sugar transfer ?





ⓐ (A).   ⓑ (B).

ⓒ (C).   ⓓ (D).

2 Which of the following is found in blood that is carried by the arterioles inside the lung ?

ⓐ Digested food.

ⓑ A higher percentage of O_2 and a lower percentage of CO_2

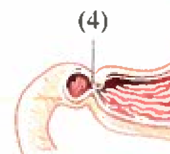
ⓒ A higher percentage of CO_2 and a lower percentage of O_2

ⓓ An equal percentage of CO_2 and O_2

3 ✱ What is the number of the removed electrons from one molecule of glucose which contribute by their transfer from a higher energy level to a lower energy level in ATP production through the electron transport chain ?

ⓐ 12   ⓑ 24   ⓒ 36   ⓓ 38

4 Some patients who have digestion complications suffer from the "Gastro-oesophageal reflux" which causes severe inflammation in the oesophagus, in which part in the opposite figure is the disturbance occurred to cause this ?



ⓐ (1).   ⓑ (2).

ⓒ (3).   ⓓ (4).

5 Which of the following valves determine the blood route which contains the highest percentage of oxyhaemoglobin substance ?

ⓐ Bicuspid valve and tricuspid valve.

ⓑ Bicuspid valve and aortic valve.

ⓒ Pulmonary valve and aortic valve.

ⓓ Bicuspid valve and pulmonary valve.

6 Which of the following gives the highest blood pressure in aorta ?

ⓐ Right atrium contraction.

ⓑ Left atrium contraction.

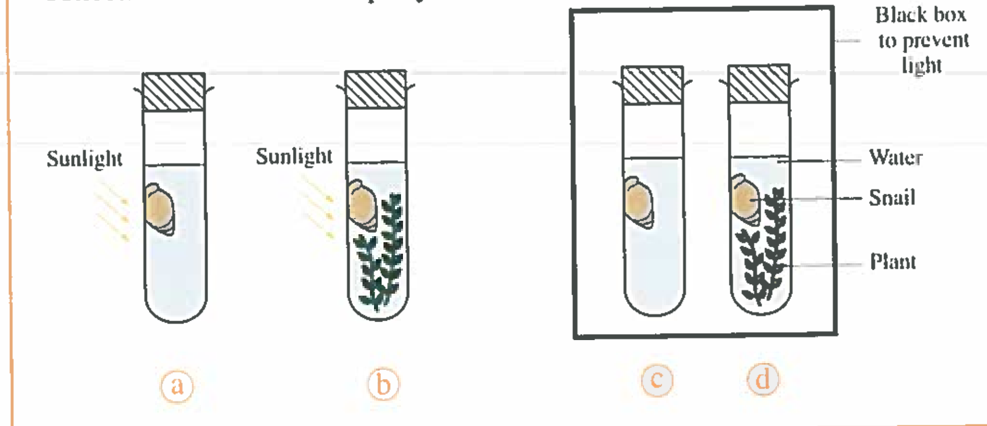
ⓒ Right ventricle contraction.

ⓓ Left ventricle contraction.

7 Which of the following substances **doesn't** transfer through the plant transport system ?

ⓐ H_2O ⓑ Glucose. ⓒ Cellulose. ⓓ Mg^{2+}

8 ✱ You have 4 test tubes as shown in the following figure, in which tube will the O_2 concentration decrease rapidly ?



9 What is the similarity between the corn plant and *Orobanche* plant ?

ⓐ Performing photosynthesis process.

ⓑ The fixation of CO_2 gas.

ⓒ Converting low-energy compounds into high-energy compounds.

ⓓ Converting organic compounds into inorganic compounds.

10 In which of the following plants do you expect that the osmotic pressure is vanished ?

ⓐ Cotton. ⓑ Bean. ⓒ Maize. ⓓ *Pinus*.

11 What happens to ketoglutaric acid when it is converted into succinic acid during cellular respiration ?

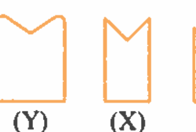
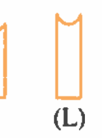
(a) It combines with O_2
(b) It consumes ATP molecules.
(c) It consumes CO_2
(d) It loses electrons.

12 Which of the following represent the reactants (substrates) for both enzymes (A) & (B) respectively ?

(a) (Y) & (L).
(b) (Z) & (L).
(c) (Y) & (X).
(d) (X) & (Z).

(A) (B)

Enzyme

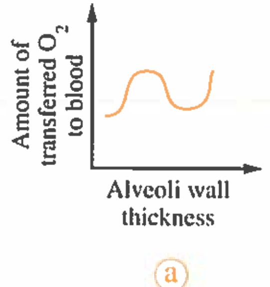
Substrate

(Y) (X) (Z) (L)

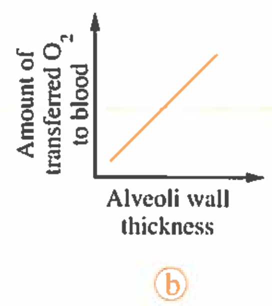
13 Which of the following **doesn't** agree with glycolysis reactions and the reactions which occur in the chloroplast stroma ?

(a) Each of them doesn't occur in one step only.
(b) PGAL compound is formed in both of them.
(c) Both of them need energy.
(d) Each of them produces CO_2

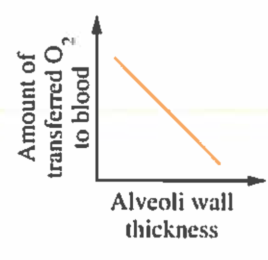
14 Which of the following graphs expresses the efficiency of air sacs (alveoli) in the two lungs ?



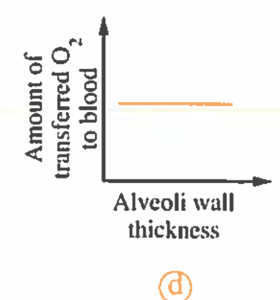
(a)



(b)



(c)



(d)



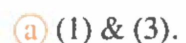
15 Which of the following occurs when placing a plant cell in a salt solution whose temperature is 90°C ?

(a) Water and salts absorption completely stops.
(b) Salts absorption completely stops and water absorption continues.
(c) Water and salts absorption partially stops.
(d) Water absorption only stops.

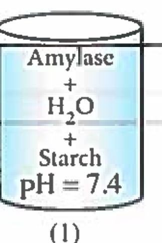
16 What is the result of the presence of a layer of cambium in the stem of a dicot plant ?

(a) An increase in the transport rate.
(b) The widening of the secondary xylem cavities.
(c) A decrease in the stem support.
(d) An increase in the length of phloem tubes.

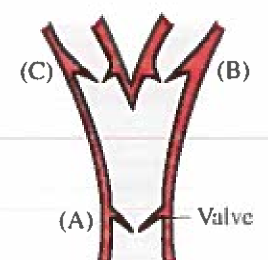
17 In the opposite figures, in which tube does the complete digestion occur when it is placed in a water bath (37°C) ?



(a) (1) & (3). (b) (3) only.
(c) (1) & (2). (d) (2) only.



18 The opposite figure shows the connection between two veins together, which of the following shows the direction of venous blood ?





(a) (C) ⟶ (A) and (A) ⟶ (B).
(b) (B) ⟶ (C) and (A) ⟶ (C).
(c) (A) ⟶ (C) and (A) ⟶ (B).
(d) (C) ⟶ (A) and (B) ⟶ (A).

19 Which of the following tissues is responsible for aeration in the plant leaves ?

(a) Palisade tissue. (b) Spongy tissue.
(c) Collenchyma tissue. (d) Vascular tissue.

20 What is the number of the resulted ATP molecules directly from Krebs cycle during the oxidation of a maltose molecule ?

(a) 1 (b) 2 (c) 4 (d) 8

21 Human body contains a group of fluids that differ in their structure, which of the following expresses the components of blood plasma ?

	Water	Urea	Antibodies	WBCs
(a)	✓	✓	✓	×
(b)	✓	✓	×	×
(c)	✓	✓	✓	✓
(d)	×	×	✓	✓

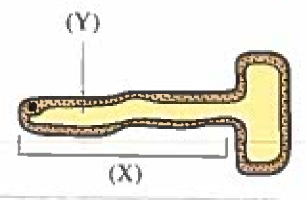
✓: Present
×: Absent

Answer the following questions (22 : 27) :

22 **Explain :** lymph plays an indirect role in blood clotting.

23 **In the opposite figure :**

What happens in case of : the absence of part (Y) from structure (X) ?

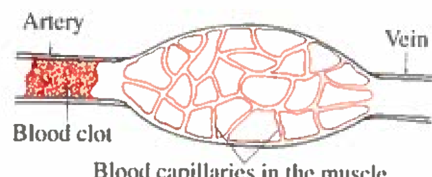


24 **What is the relation between :** the conversions of ATP into ADP and the compounds formed during glycolysis ?

25 **The opposite figure** illustrates the formation of a blood clot inside an artery of a certain muscle.

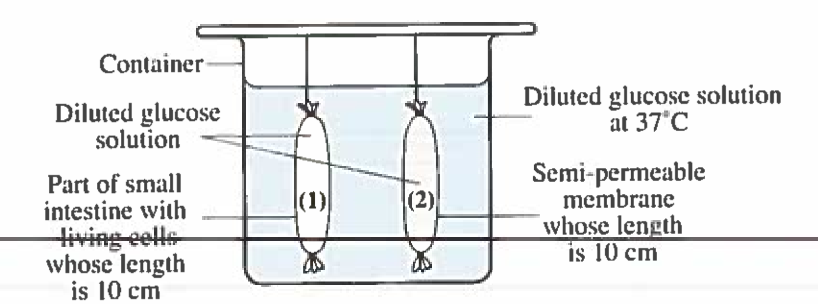
Mention the name of the harmful substance that accumulates in the tissues of the muscle.

Explain your answer.



26 PGAL is formed during two important processes that you have studied, **determine the role of this compound in each of the two processes.**

27 **From the following figure :**



Deduce which of the two structures no. (1) or (2) contains a lower percentage of glucose concentration after two hours. **Explain your answer.**

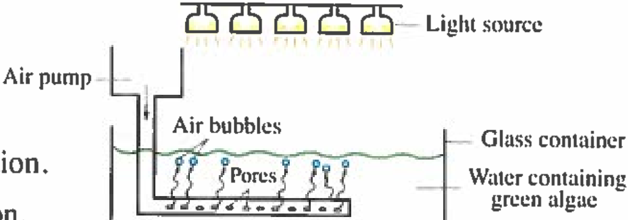
General Exam 8





Choose the correct answer (1 : 21) :

1 In the opposite figure, what is the gas that is supplied to green algae from the air pump ?



(a) CO_2 that is required for their respiration.
(b) O_2 that is required for their respiration.
(c) CO_2 that is required to perform photosynthesis process.
(d) O_2 that is required to perform photosynthesis process.

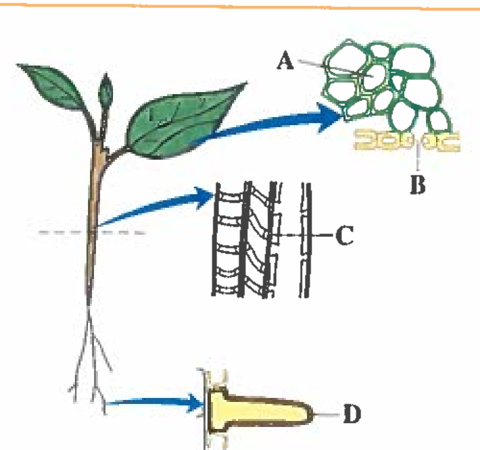
2 ✱ What do you expect when examining a complete blood count for a woman suffering from general weakness, high rate of heartbeats and high respiration rate ?

(a) An increase in the number of red blood corpuscles.
(b) An increase in the number of white blood corpuscles.
(c) A decrease in the number of red blood corpuscles.
(d) A decrease in the number of white blood corpuscles.

3 ✱ Which of the following that the amount of energy released from a fatty acid **doesn't** depend on it after completing Krebs cycle ?

(a) The number of acetyl groups that are resulted from its breaking down.
(b) The number of carbon atoms which enter in its composition.
(c) The accomplishment of electron transport chain.
(d) The number of coenzymes (A).

4 Which of the following arrows **doesn't** direct the pathway of H_2O molecules in the opposite figure ?



(a) 
(b) 
(c) 
(d) B↓

5 Which of the following reactions require the presence of CO_2 gas ?

ⓐ Light reactions only.
ⓑ Dark reactions only.
ⓒ Light and dark reactions.
ⓓ Glycolysis reactions.

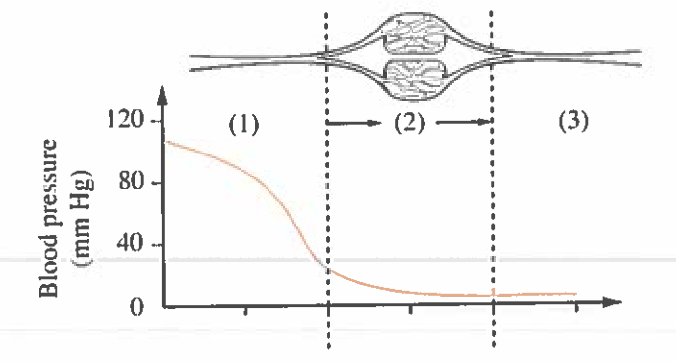
6 When staining a transverse section of a dicot plant stem with iodine solution, which of the following is/are expected to appear with a dark blue colour ?

ⓐ Xylem vessels.
ⓑ Companion cells.
ⓒ Cambium.
ⓓ The innermost row of cortex.

7 ✱ The opposite figure illustrates the blood flow in the blood vessels, what does part no. (3) represent ?



ⓐ Artery.
ⓑ Vein.
ⓒ Blood capillaries.
ⓓ Lymphatic vessel.



8 What is the ratio between the number of $FADH_2$ molecules to that of NADH molecules that are resulted from the complete oxidation of a molecule of glucose in aerobic conditions ?

ⓐ 1 : 5
ⓑ 3 : 1
ⓒ 5 : 1
ⓓ 1 : 3

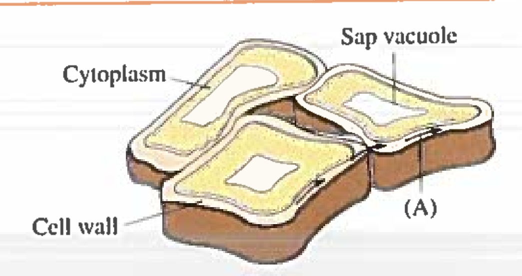
9 Gallbladder was removed from a person, which of the following is expected to occur ?

ⓐ He can't eat carbohydrates.
ⓑ He can eat fats in small amounts.
ⓒ He can take drinks only.
ⓓ He can't eat more than one big meal daily.

10 From the opposite figure, what is the phenomenon by which substance (A) transfers ?

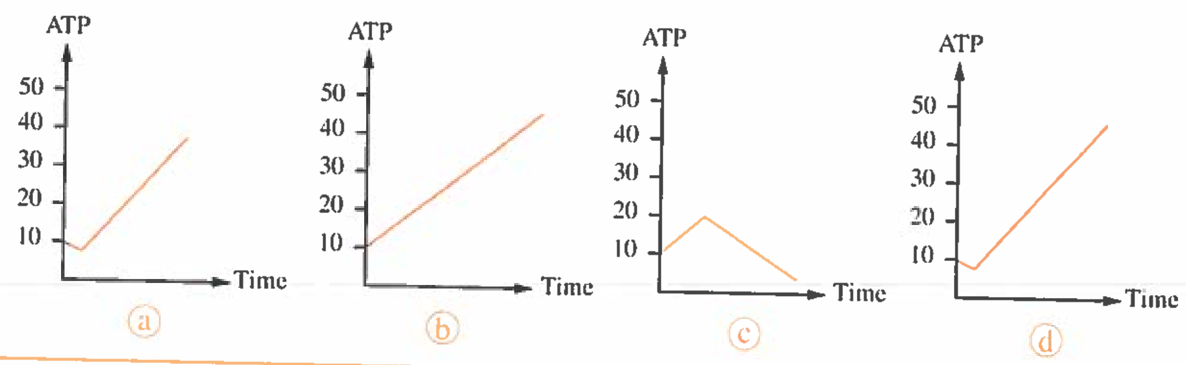


ⓐ Osmosis.
ⓑ Imbibition.
ⓒ Diffusion.
ⓓ Active transport.

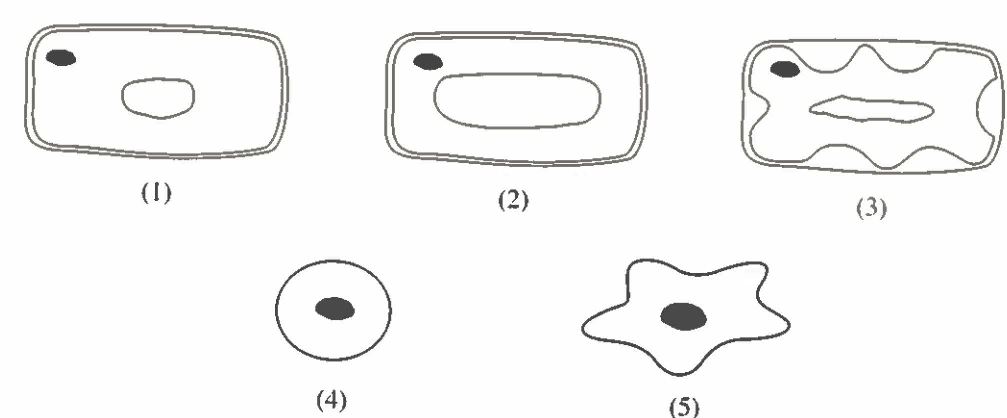




11 ✱ If we supposed that the cell storage for energy is 10 ATP molecules, which of the following graphs represents the number of ATP molecules after the aerobic oxidation for one glucose molecule with time ?



12 The following figures show some plant and animal cells after placing them in two sucrose solutions that have different concentrations (knowing that their osmotic pressure = 0.5 % of the sucrose solution) :



Which of the previous cells were placed in these two solutions ?

	Sugar solution (1%)	Sugar solution (0.1%)
a	Cell (1) & Cell (2)	Cell (3) & Cell (5)
b	Cell (1) & Cell (4)	Cell (3)
c	Cell (2) & Cell (4)	Cell (1) & Cell (3)
d	Cell (3) & Cell (5)	Cell (2) & Cell (4)

13 What is the amount of protein that is found in each 100 cm^3 of plasma in a normal person ?

a 5 g
b 3 g
c 7 g
d 9 g

14 * Study the following graph which shows some products of aerobic cellular respiration reactions :

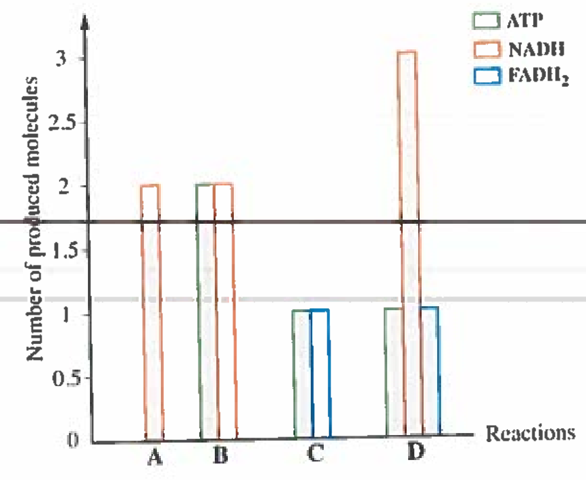
Which reaction occurs in the cytoplasm of the cell ?

ⓐ (A).

ⓑ (B).

ⓒ (C).

ⓓ (D).



15 Which type of food can be digested in both acidic and alkaline media ?

ⓐ Rice. ⓑ Potato. ⓒ Fat. ⓓ Meat.

16 Which of the following blood vessels contains the highest amount of glucose in human body after eating a balanced meal ?

ⓐ Inferior vena cava. ⓑ Hepatic portal vein.

ⓒ Pulmonary artery. ⓓ Hepatic vein.

17 What is the similarity between the green plants and purple-sulphur bacteria ?

ⓐ The type of chlorophyll in both of them.

ⓑ The source of hydrogen required for CO_2 fixation in both of them.

ⓒ The dark reactions in both of them.

ⓓ The secondary products of photosynthesis process in both of them.

18 What are the types of food needed by a person who practices bodybuilding ?

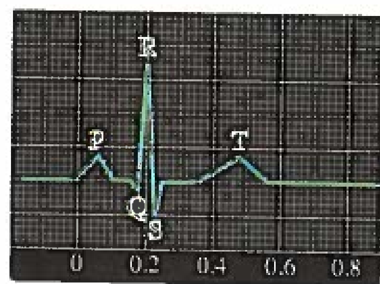
ⓐ Juices & vegetables.

ⓑ Rice & juices.

ⓒ Meat & juices.

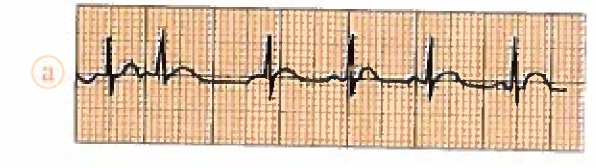
ⓓ Rice & vegetables.

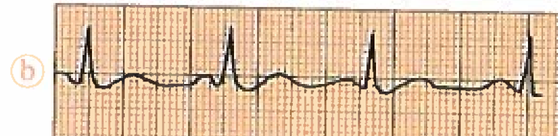
19 The following figure represents a part of the normal electrocardiogram for the human heart, if you know that :

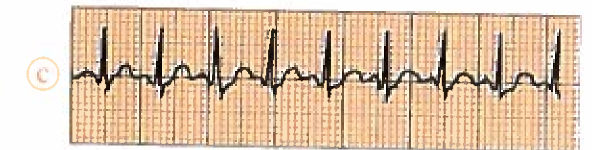


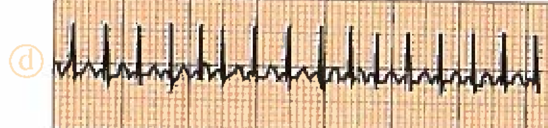
- Part (P) represents contraction of atria to pump the blood to ventricles.
- Part (QRS) refers to the contraction of ventricles to pump the blood outside the heart.
- Part (T) expresses the secondary contraction of ventricles to pump blood residues outside the heart.

Which of the following diagrams represents the slow heartbeats rate ?

ⓐ 

ⓑ 

ⓒ 

ⓓ 

20 Normal plants are cultivated in desert and small number of them adapted well with this environment, which of the following factors its increase leads to the well adaptation of these plants ?

ⓐ The tallness of vegetative parts of the plant.

ⓑ The concentration of cell sap of root cells.

ⓒ The shortness of the root.

ⓓ The small volume of sap vacuoles of the root.

21 In which of the following cases is the highest value of blood pressure ?

ⓐ Relaxation of left ventricle.

ⓑ Contraction of right ventricle.

ⓒ Opening of mitral valve.

ⓓ Opening of aortic valve.

Answer the following questions (22 : 27) :

22 Most of water that is absorbed by the plant evaporates.

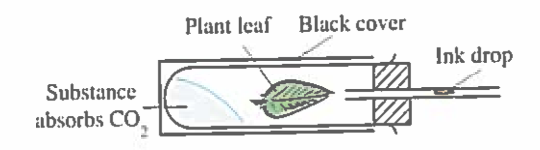
Deduce what is the benefit from the small amount of water that the plant keeps.

23 **Explain :** proteins that are produced by the plant cells to perform the required vital processes can't penetrate through their plasma membranes.

24 There is a reaction that links between glycolysis and Krebs cycle during the cellular respiration, **illustrate the products of this reaction.**

25 **What is the difference between :** the blood capillaries that are present in villi and that are present in the alveoli ?

26 **From the opposite figure :**



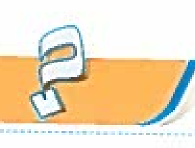
(a) **Determine** the direction of the ink drop movement in the tube.

(b) **Explain** why the substance that absorbs CO_2 is added.

27 "Stomach has an important role in protecting the human body".

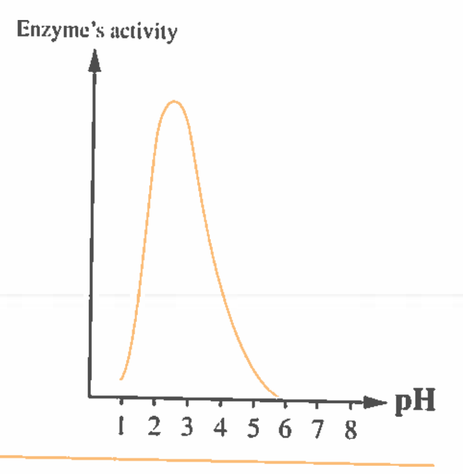
How far the statement is correct ? With explanation.

General Exam 9



Choose the correct answer (1 : 21) :

1 The opposite graph shows the effect of pH on the rate of a digestive enzyme activity, where is the enzyme found ?



(a) In bile.

(b) In gastric juice.

(c) In intestinal juice.

(d) In pancreatic juice.

2 Which of the following produces the lowest number of ATP molecules ?

(a) $FADH_2$ molecule in the electron transport chain.

(b) The acidic fermentation.

(c) The alcoholic fermentation.

(d) One Krebs cycle.

3 * If the stored energy is not released from the coenzymes during the electron transport chain, what is the number of ATP molecules which are resulted from the oxidation of one molecule of glucose aerobically ?

(a) 3 molecules. (b) 4 molecules.

(c) 8 molecules. (d) 16 molecules.

4 * A blood sample was taken from a blood vessel in the patient body, on examining its external appearance, it was found that its colour is light red. What is the expected place for this sample to be taken from ?

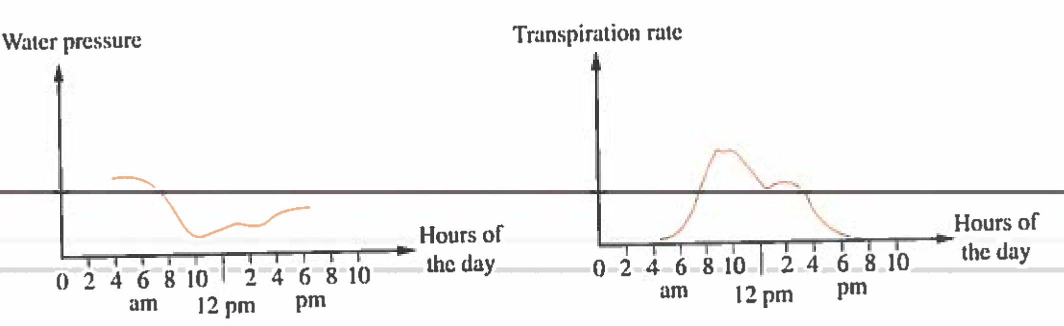
(a) A blood vessel near to the skin surface.

(b) A blood vessel buried among muscles.

(c) Blood capillaries near to the skin surface.

(d) Blood capillaries buried among muscles.

5 The two following graphs illustrate the rate of the transpiration process and the water pressure in the plant leaf cells within the day hours :



What do you conclude from your study to the previous graphs ?

ⓐ The water pressure decreases inside the leaf cells with increasing the transpiration process.

ⓑ The water pressure increases inside the leaf cells with increasing the transpiration rate.

ⓒ The stomata of the leaf closes at 10 am.

ⓓ The stomata of the leaf opens at 4 am.

6 What is the process that occurred in the chloroplast and is opposite to the process of the photosynthetic phosphorylation ?

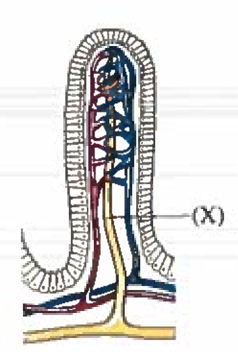
ⓐ The production of ATP from ADP in the grana.

ⓑ The production of ADP from ATP in the grana.

ⓒ The production of ATP from ADP in the stroma.

ⓓ The production of ADP from ATP in the stroma.

7 Which of the following that the decrease in its production rate leads to a decrease in the food substances that are transferred to structure (X) ?



ⓐ Bile juice.

ⓑ Pepsin.

ⓒ Amylase.

ⓓ Sucrase.



8 In each of the alcoholic fermentation and the acidic fermentation, 2 molecules of ATP are released. So, what is the expected number of the resulted kilocalories from the hydrolysis of the released ATP molecules ?

ⓐ From the alcoholic fermentation is greater than that from the acidic fermentation.
ⓑ From the alcoholic fermentation is lower than that from the acidic fermentation.
ⓒ It is equal in the two types of fermentation.
ⓓ From each of them is greater than that from the aerobic respiration.

9 Which of the following statements **doesn't** illustrate the transport process of water in the plant ?

ⓐ Most of the released water from the leaf gets out through the stomata.
ⓑ The cohesion between the molecules of water causes the presence of a continuous column of water.
ⓒ The resulted effect from the transpiration process causes the presence of the continuous attraction of water column upward.
ⓓ The adhesion force between molecules of water and xylem vessels causes the column of water to be held continuously.

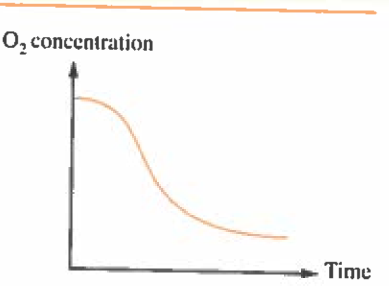
10 In the opposite diagram, what is the common factor between the two processes (1) and (2) ?

ⓐ The need for O_2
ⓑ The need for CO_2
ⓒ The need for energy.
ⓓ The need for FAD presence.

A
B
(1)
(2)
38 ATP+ E + D
C +2 ATP

11 ✱ What is the blood vessel expressed in the opposite graph ?

ⓐ Pulmonary artery.
ⓑ Renal artery.
ⓒ Vena cava.
ⓓ Hepatic vein.



12 During preparation of a T.S. of a new dicot plant stem, iodine was added to the stem sample to enhance the examination, which tissue do you expect its cells **won't** be stained with the dark blue colour ?

ⓐ Cambium.
ⓑ Cortex.
ⓒ Medullary rays.
ⓓ Pith.

13 ❋ Which of the following represents the mechanism of absorbing the products of starch digestion ?

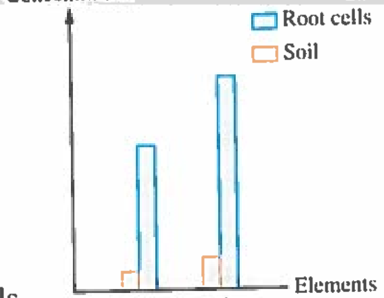
ⓐ Diffusion to the arterioles (arterial capillaries).

ⓑ Active transport to the lacteal vessel.

ⓒ Diffusion to the lacteal vessel.

ⓓ Active transport to the venules (venous capillaries).

14 Study the opposite graph which shows the plant need for (X) and (M) elements to perform vital processes, what is the factor that helps in increasing the concentration of (X) and (M) inside the root cells ?



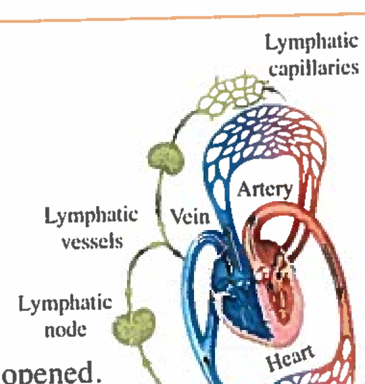
ⓐ Plenty of water inside sap vacuoles of the root cells.

ⓑ The decrease of sugar inside sap vacuoles of the root cells.

ⓒ The decrease of O_2 inside the root cells.

ⓓ Plenty of O_2 inside the root cells.

15 The opposite figure shows the relation between the lymphatic system and the circulatory system, what do you deduce from this figure ?



ⓐ Both of them are closed systems.

ⓑ Both of them are opened systems.

ⓒ Circulatory system is closed, while lymphatic system is opened.

ⓓ Circulatory system is opened, while lymphatic system is closed.

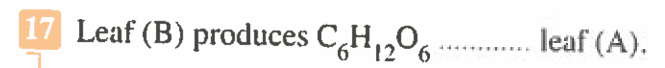
16 When eating a meal contains bread, rice and potatoes, what is/are the enzyme(s) that will digest all these food substances ?

ⓐ Amylase and maltase.

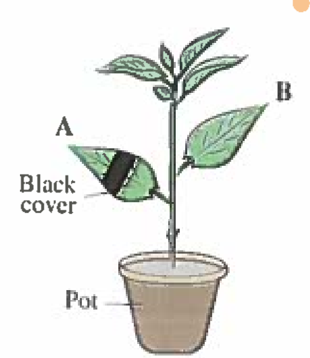
ⓑ Lipase and maltase.

ⓒ Amylase and lipase.

ⓓ Lipase and peptidase.

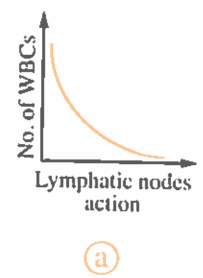


17 Leaf (B) produces $C_6H_{12}O_6$ .... leaf (A).

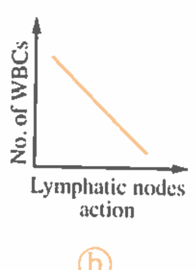


- (a) more than
- (b) less than
- (c) equal to
- (d) twice

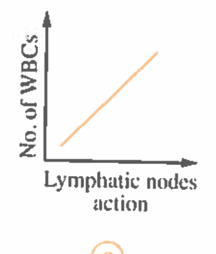
18 Which of the following graphs represents the immunity performance for a person body in the first days of a bacterial infection ?



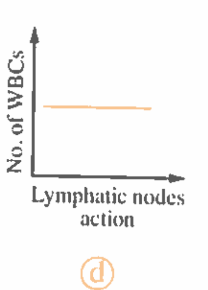
(a)



(b)



(c)



(d)

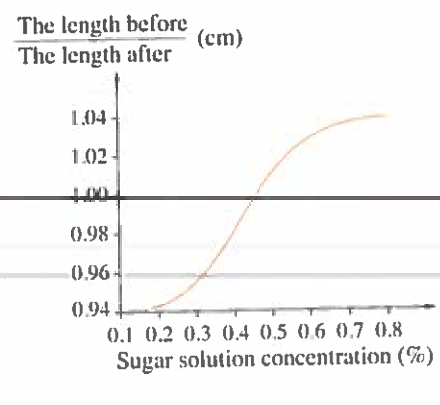
19 * In your opinion, why does NADH give 3 ATP molecules, while $FADH_2$ gives 2 ATP molecules only ?

- (a) NADH molecules give their electrons to the cytochrome at higher energy levels.
- (b) $FADH_2$ molecules give their electrons to the cytochrome at higher energy levels.
- (c) NADH molecules don't give all their electrons to the cytochromes.
- (d) $FADH_2$ molecules don't give all their electrons to the cytochromes.

20 Which of the following are permeable to water ?

- (a) Cellulose walls.
- (b) Walls covered by lignin.
- (c) Walls covered by cutin and suberin.
- (d) Plasma membranes and cellulose walls.

21 Several sections of castor plant having the same length were put in a serial concentrations of sucrose sugar, their length was measured before and after treating, the following graph shows the ratio between the length before and the length after with the sugar solution concentration, which of the following concentrations for sucrose solution has the same concentration of cell sap of the plant before soaking in the sugar solution ?



(a) 0.1%

(b) 0.25%

(c) 0.45%

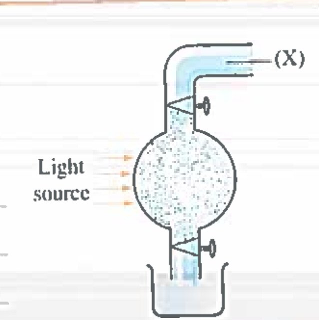
(d) 0.8%

Answer the following questions (22 : 27) :

22 **Give reason for :** the heartbeats of boxing champions reach about 180 beats/minute at the top of the competition.

23 **What happens in case of :** the exposure of the plant to an infection with a microbe and it reaches the xylem vessels (according to the transport process) ?

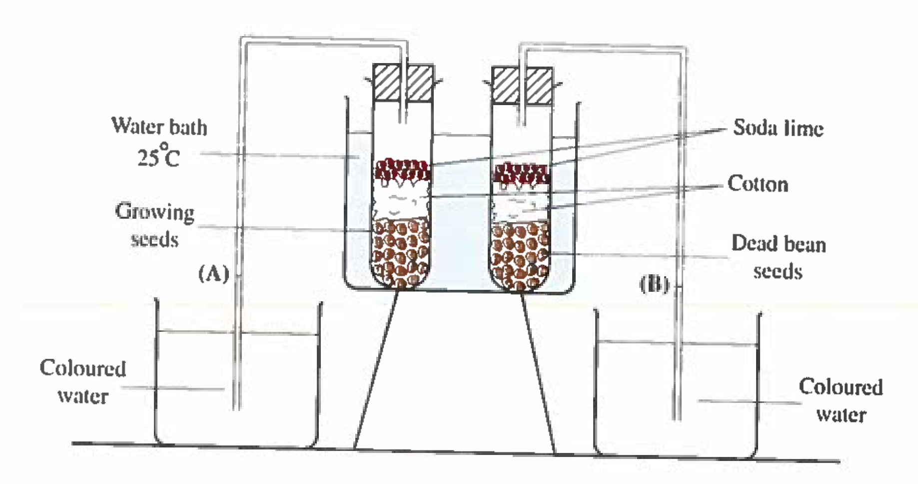
24 **The opposite figure illustrates the experiment of Calvin, what do you expect to happen if** the system is supplied with element (X) intermittently ?



25 "The respiration rates may increase in the root hair during the absorption of the mineral salts". **How far the statement is correct ? With explanation.**

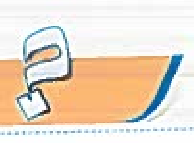
26 The doctor may recommend a medicine for the patient, that is taken through venous injection not by mouth. **Suggest two reasons for that.**

27 **From the following figure :**



Deduce what happens in each level of (A) and (B) after passing a period of time. **Explain your answer.**

General Exam 



Choose the correct answer (1 : 21) :

1 In which of the following parts of the human digestive system does the process that is illustrated in the opposite figure occur ?

Protein → X Y Z L

ⓐ Stomach and small intestine. ⓑ Mouth and stomach.

ⓒ Oesophagus and small intestine. ⓓ Mouth, stomach and duodenum.

2 Which of the following produces the highest amount of energy ?

ⓐ The oxidation of phosphoglyceraldehyde aerobically.

ⓑ The oxidation of malic acid to oxaloacetic acid.

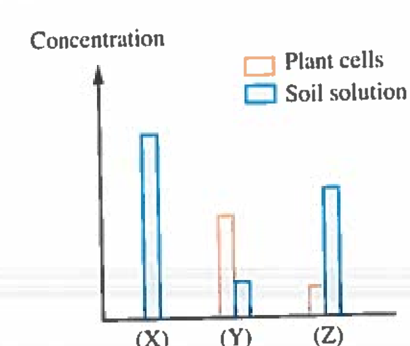
ⓒ The acidic fermentation of pyruvic acid.

ⓓ The alcoholic fermentation of pyruvic acid.

3 Which of the following can be used as a drug to prevent the formation of blood clots for some patients ?

ⓐ Fibrin. ⓑ Fibrinogen. ⓒ Heparin. ⓓ Thrombin.

4 * The opposite graph illustrates the concentration of elements (X), (Y) & (Z) in the cells of a plant and in the soil solution, which of the following element(s) do the rates of respiration during its(their) absorption increase ?



ⓐ (X). ⓑ (Y).

ⓒ (Z). ⓓ (X) and (Z).

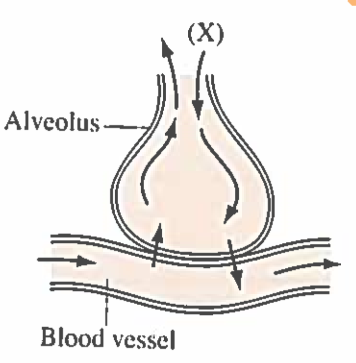
5 Which of the following tissues is **not** present in the leaf of cotton plant ?

ⓐ Mesophyll tissue. ⓑ Xylem.

ⓒ Phloem. ⓓ Cambium.



6 In the opposite figure, which of the following factors works on increasing the penetration rate of gas (X) from the alveolus to the blood vessel ?



(a) Increasing the thickness of the alveolus wall.

(b) Increasing the surface area of the alveoli.

(c) Decreasing the concentration of gas (X) in the alveoli.

(d) Decreasing the respiration rate.

7 Which of the following valves direct the blood route which contains the highest percentage of carbo-aminohaemoglobin substance ?

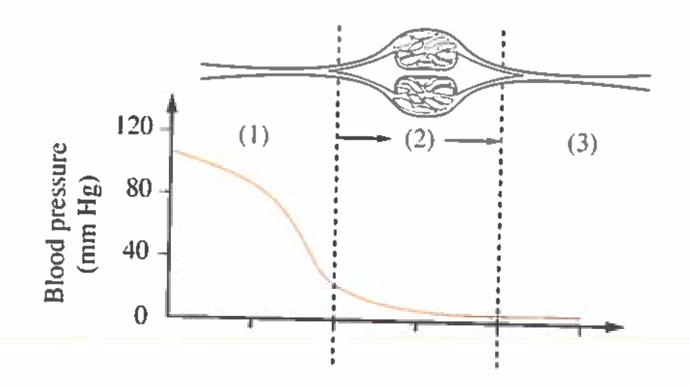
(a) Mitral valve and tricuspid valve.

(b) Mitral valve and aortic valve.

(c) Pulmonary valve and aortic valve.

(d) Tricuspid valve and pulmonary valve.

8  The opposite figure illustrates the blood flow in the blood vessels, what does part no. (1) represent ?



(a) Artery.

(b) Vein.

(c) Blood capillaries.

(d) Lymphatic vessel.

9 Which of the following statements agrees with Krebs cycle ?

(a) It is always related to glycolysis process to form pyruvic acid.

(b) It occurs inside the mitochondria.

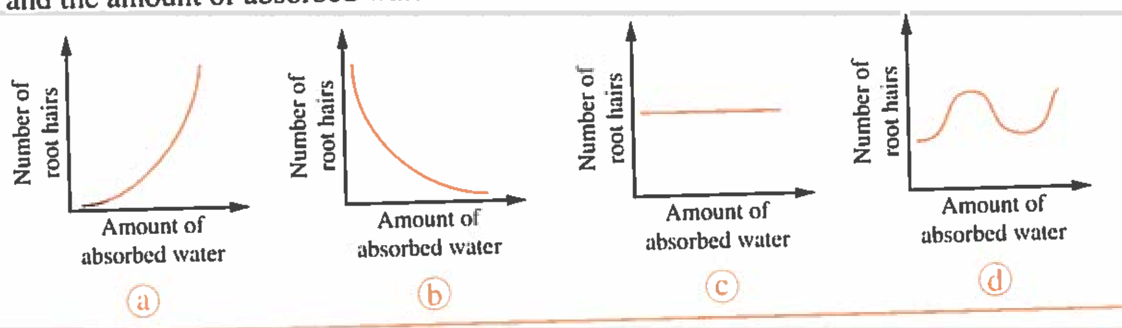
(c) The biggest direct source to produce ATP molecules in the cell.

(d) Pyruvic acid is an intermediate compound in it.

10 What is the phenomenon by which the gas exchange process between the air present inside the alveolus and the blood in the two lungs takes place ?

ⓐ Osmosis.
ⓑ Diffusion.
ⓒ Active transport.
ⓓ Imbibition.

11 Which of the following graphs represents the relation between the number of root hairs and the amount of absorbed water ?



12 * Which of the following blood components can the body make benefit from them through their different stages ?

ⓐ Platelets.
ⓑ WBCs
ⓒ Plasma proteins.
ⓓ RBCs

13 What is the process that occurs to NADH when pyruvic acid is converted into lactic acid ?

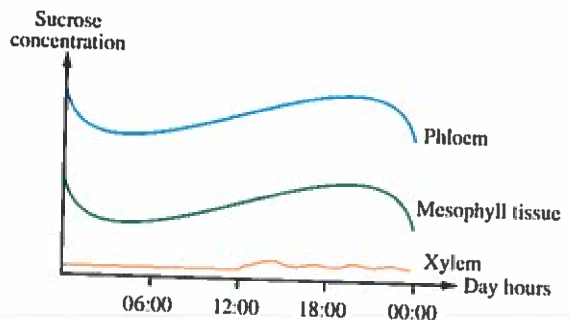
ⓐ Reduction.
ⓑ Oxidation.
ⓒ Splitting.
ⓓ Decomposition.

14 Which of the following digestive organs may have dysfunction in a person. So, the doctors advised him not to eat more food rich in fats ?

ⓐ Pancreas.
ⓑ Small intestine.
ⓒ Oesophagus.
ⓓ Stomach.



15 ✱ The following graph shows the results of measuring sucrose concentration in three different tissues in the leaf of a dicot plant during 24 hours :



Which of the following can be concluded from that graph ?

- (a) Water moves by osmosis from xylem tissue to phloem tissue.
- (b) Sucrose moves by active transport from the mesophyll tissue of the leaves then to the phloem.
- (c) Sucrose moves in both directions in the phloem.
- (d) Xylem tissue uses sucrose sugar as a source of energy.

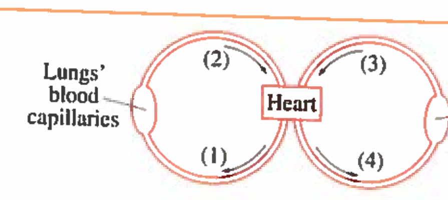
16 What is the similarity between the chloroplasts and mitochondria ?

- (a) The presence of DNA molecules.
- (b) The presence of NAD^+ molecules.
- (c) The production of sugar molecules.
- (d) Glycolysis (splitting of glucose molecules).

17 "Babies' milk contains lactose sugar", how can the baby make benefit from this sugar ?

- (a) Lactose is a delayed source for the energy production.
- (b) Lactose transfers through cell membranes to be absorbed fastly.
- (c) Lactose contains higher stored energy than milk protein.
- (d) The breaking down of chemical bonds among lactose molecules results in monosaccharides with high rate.

18 ✱ In the opposite figure, which of the following blood vessels carry blood at high pressures ?



- (a) (1) & (2).
- (b) (1) & (4).
- (c) (2) & (3).
- (d) (2) & (4).

19 What is the result of narrowing the xylem tubes diameter in plant stem ?

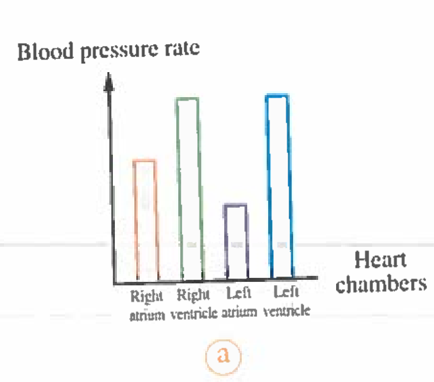
(a) The inability of water transfer through xylem tubes.

(b) Water and salts transfer by capillarity phenomenon.

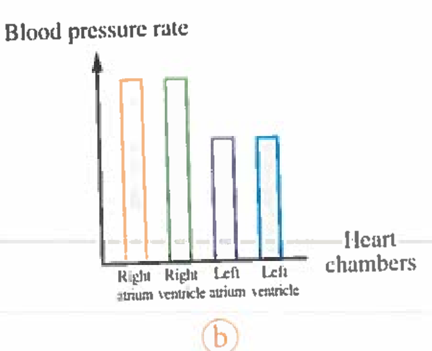
(c) Water and salts transfer by capillarity phenomenon and adhesion.

(d) The lignin precipitation inside xylem tubes' cavity.

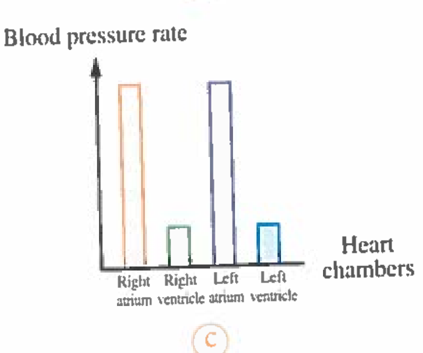
20 Which of the following graphs expresses the strength of chambers muscles contraction in the human heart ?



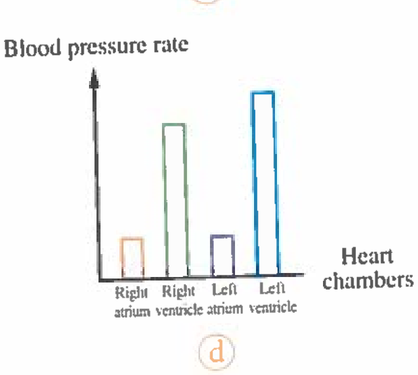
(a)



(b)



(c)



(d)

21 Which of the following uses the sunlight directly ?

(a) Production of ATP molecules.

(b) Movement of chlorophyll molecule electrons.

(c) Water molecules splitting.

(d) $NADPH_2$ molecules formation.

Answer the following questions (22 : 27) :

22 **Explain :** the presence of root hairs in the bean plant, despite their continuous penetration in the soil.

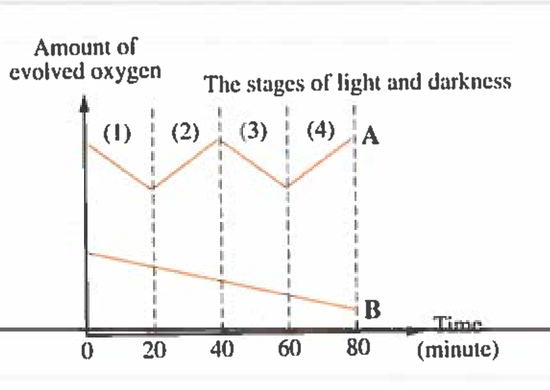
23 **What** is the least number of each molecule of NADH and $FADH_2$ at which the number of ATP molecules resulted from them is equal ?

24 **Write what this statement indicates :** "An organ in the body through which oxygenated and deoxygenated blood enter inside it and the deoxygented blood comes out from it".

25 "Superior vena cava carries the completely digested substances".
How far the statement is correct ? With explanation.

26 The radioactive carbon has an important role in proving some vital processes inside the plant. **Give two different examples.**

27 An aquatic plant was put in a medium containing water $H_2^{18}O$ and mineral salts, where water contains dissolved oxygen ($^{16}O_2$) and also a source of carbon dioxide ($C^{16}O_2$), then the plant exposed to light and darkness in a successive manner.



From the opposite graph :

(a) **Which** of the stages from (1) : (4) represents the darkness ?

(b) **Which** curve represents oxygen (^{16}O) ?

ترخيص وزارة التربية والتعليم : ١٠٤ / ١٣ / ٢ / ٢٠٧

Answers of General Exam 1

1 ⓒ (Y), (Z).

2 ⓓ Lactic acid from pyruvic acid.

3 ⓐ 4.5

4 ⓑ Vascular bundle / Pericycle / Cortex / Epidermis.

5 ⓒ Limewater is clear.

6 ⓑ 2

7 ⓒ Peptidase.

8 ⓓ (1) and (4).

As part (1) represents the xylem tissue in the leaf section that is present outward in the vascular bundle and part (4) represents also the xylem tissue in the stem section that is present inward in the vascular bundle, the xylem tissue is responsible for the transport of water and salts in plant. So, the two parts (1) and (4) are stained by the coloured water.

9 ⓓ Fibrinogen.

10 ⓒ Respiratory enzymes.

11 ⓐ Meat.

12 ⓑ Sugar and amino acids transfer together by active transport in the same sieve tube of phloem.

As from the important vital processes that is performed by the sieve tube in phloem is the active transport of sugar and amino acids against the concentration gradient and this process requires energy that is given to the sieve tube in the form of ATP molecules from the mitochondria of the companion cell through the plasmodesmata.

13 ⓑ 70 mm Hg

14 ⓓ Yeast fungus.

As the graph starts with (6C) compound (glucose) that is passed by more than one stage till its splitting (during glycolysis) into (3C) compound (pyruvic acid) to reach (2C) compound (ethyl alcohol) in addition to a molecule of (1C) compound (carbon dioxide) that indicates the occurrence of alcoholic fermentation which is a type of respiration that is used by yeast fungus.

15 ⓐ

16 ⓒ The flow rate of solutes during transmission.

17 ⓓ Oxyhaemoglobin.

18 ⓐ Active transport and diffusion.

19 ⓐ 150

As each molecule after the electron transport chain gives 15 ATP molecules (from 4 NADH molecules, 1 $FADH_2$ molecule and one ATP molecule directly), i.e. the result for 10 pyruvic acid molecules = $15 \times 10 = 150$ ATP molecules.

20 ⓑ It will shrink, due to H_2O exit from its sap vacuole.

21 ⓑ Pyruvic acid oxidation and completing two Krebs cycles.

22 As the leaves in which the high-energy organic food substances (carbohydrates, fats and proteins) are manufactured and they will be transported through the sieve tubes of the phloem to the different plant parts for storage and consumption.

23 When the RBCs become old, they are broken down and the body restores their proteins to use them in the formation of the bile juice that converts fats into emulsified fats to facilitate their digestion.

24 **(a)** HCl acid of the gastric juice.

(b) Sodium bicarbonate of the pancreatic juice.

25 Absence of coenzymes or cytochromes.

26 The lung gets O_2 from the inhaled air then the blood capillaries surrounding the alveolar air receives O_2 and transfers it to the body parts through the oxygenated blood and another amount of O_2 lost from the two lungs as water vapour in the exhaled air, while CO_2 enters the lungs from the deoxygenated blood then gases exchange takes place between the alveolar air and the surrounding blood in the blood capillaries to supply the body with O_2 and get rid of CO_2 through the exhaled air.

27 • (X) : doesn't change.

• (Y) : changes into dark blue colour.

Answers of General Exam 2

1 ⓑ (2).

2 ⓐ Glycolysis.

3 ⓓ The concentration of maltose in the fourth minute is higher than the concentration of starch.

As amylase enzyme acts on the hydrolysis of starch into maltose sugar, where the action of this enzyme continues, leading to increasing the concentration of maltose gradually and decreasing the concentration of starch gradually till hydrolyzing all the starch molecules into maltose.

4 ⓒ The percentage of N_2 in the inhaled air with its percentage in the exhaled air.

As nitrogen enters with the inhaled air and comes out with the exhaled air without spreading in blood.

5 ⓒ P

6 ⓒ The first statement is correct and the second statement is wrong.

7 ⓑ 10

As the entry of one molecule of pyruvic acid to complete one Krebs cycle results in 3 NADH molecules, therefore the number of pyruvic acid molecules that give 30 NADH molecules $= \frac{30}{3} = 10$ molecules.

8 ⓑ Fatty acids.

9 ⓐ Plasma and white blood corpuscles.

As the enucleated cells are the red blood corpuscles that are found in the blood fluid (Y) that shares with lymph (X) in the presence of plasma and white blood corpuscles that are expressed by (Z).

10 ⓒ The type of chlorophyll and the source of hydrogen required to reduce CO_2 in each one of them.

11 ⓓ H_2O splitting in the photosynthesis process.

12 ⓓ Exit of water from the lips' cells that leads to their shrinkage.

13 ⓒ 8

14 ⓐ Superior vena cava.

15 ⓑ Lactic acid / Glucose.

16 ⓑ Left ventricle.

17 ⓐ AB

18 ⓓ Sap transfer.

19 ⓐ *Chlorella* alga.

20 ⓒ *Elodea*.

21 ⓐ ATP

22 The solution in tube (X) remains clear, as the boiling kills the protoplasm. So, seeds can't respire.

23 Because of the high rate of transpiration at noon and its lower rate at night.

24 The plant will wilt and die.

25 **(a)** Because point (A) "atrio-ventricular node" is stimulated when the electrical nerve impulse reaches it from the sino-atrial node.

(b) The contraction of (B) "ventricles" is important in pushing all the oxygenated blood of the left ventricle through the aorta and all the deoxygenated blood of the right ventricle through the pulmonary artery.

26 **The statement is correct** / As when the O_2 is available the cell performs aerobic respiration to produce the energy "38 ATP" required for the vital processes of the cell.

27 **(a)** (2) Pancreas.

(b) (1) Stomach.

Answers of General Exam 3

1 ⓑ Hepatic portal vein.

2 ⓐ

As the plant absorbs water through the xylem vessels that are present inward in the vascular bundle of plant stem. So, it appears coloured in the transverse section.

3 ⓓ The iron and haemoglobin level decreases in blood.

4 ⓒ The absorption of macro-nutrients only.

As the diffusion of elements against the concentration gradient requires the occurrence of active transport that takes place in the presence of energy stored in ATP molecules that contain a macro-nutrient element which is phosphorus element, where these molecules are supplied through the cellular respiration of plant at the presence of respiratory enzymes which some of them need the activation by some micro-nutrients.

5 ⓓ Opening of aortic valve.

As during the relaxation of the two atria, the two ventricles are in case of contraction, where the atrio-ventricular valves (tricuspid and mitral valves) are closed, and the pulmonary and aortic valves are opened.

6 ⓑ (2).

7 ⓒ The wall of alveolus is thin and has a large surface area.

8 ⓒ When the two atria contract, the semi-lunar valves open.

9 ⓐ The difference in the released energy amount from one molecule of glucose.

As the fermentation in yeast is alcoholic fermentation that results in (2C) compound (ethyl alcohol) and carbon dioxide, while the fermentation in a fatigued muscle fiber is acidic fermentation that results in (3C) compound (lactic acid) only, i.e. the yeast fermentation in which the breaking down of a large number of bonds among carbon atoms in pyruvic acid takes place. Therefore, a large number of kilocalories will be resulted from the hydrolysis of ATP molecules.

10 ⓓ Oxygen.

11 ⓒ The enzymes that are present in them become inactive by heating and cooking.

12 ⓓ 8

13 ⓑ (B).

14 ⓐ Epithelial layer.

15 ⓑ Bacteria.

As the graph starts with glucose molecule (6C) that is passed by more than one stage before its splitting into pyruvic acid (3C) which is converted into lactic acid (3C), where this type of respiration (acidic fermentation) occurs in most of bacteria.

16 ⓓ Spleen.

17 ⓐ

18 ⓒ The release of O_2

As the presence of ATP molecules in a greater number than ADP molecules is occurred in the light reactions where ADP is converted into ATP through which the splitting of water molecules takes place to release O_2 gas, while the oxidation of $NADPH_2$ and the reduction of CO_2 gas are two processes occurred in the dark reactions.

19 ⓐ oxidizing lactic acid.

20 ⓒ

21 ⓑ O_2 and CO_2

22 Both of them can take place in the absence of oxygen accompanied by coenzymes reduction and produce ATP molecules.

23 *Answer by yourself.*

24 L

25 As the stomata of the herbaceous plant stem help in exchanging the respiratory gases between the stem cells and air, where O_2 diffuses into the stem and goes to all the cells of the plant, while the woody stem contains lenticels instead of stomata and they allow the exchange of respiratory gases between air and the cells of woody stem.

26 **The statement is wrong** / Because there is a group of respiratory enzymes which help in the aerobic and anaerobic cellular respiration processes.

27 The cell is in an active state, because it consumes ATP molecules and converting them into ADP molecules to use the ATP released energy.

Answers of General Exam 4

1 ⓒ

2 ⓓ 3-carbon compound is formed in each one of them.

3 ⓒ Pulmonary vein.

4 ⓓ 8

To obtain the energy from a molecule of maltose, it is hydrolyzed first into two glucose molecules, where the oxidation of one glucose molecule gives 4 molecules of CO_2. So, when Krebs cycle occurs twice, therefore maltose molecule gives 8 molecules of CO_2

5 ⓑ

6 ⓓ $NADPH_2$ and ATP

7 ⓑ Carbo-aminohaemoglobin.

8 ⓒ One Krebs cycle.

As one Krebs cycle produces one ATP molecule directly.

9 ⓓ A bronchiole.

10 ⓒ Pancreas.

11 ⓐ Water.

12 ⓐ 1 : 3

13 ⓓ Amino acids.

As the decrease in the amount of food substance in stomach into its half (50 g) indicates its digestion, i.e. it is formed of protein and the continuity of decreasing its amount in the small intestine where the digestion of protein into amino acids is completed.

14 (b) Increases / Decreases

15 (a) Opening the valve when the muscles contract.

16 (c) Diffusion.

17 (c)

18 (d) Lipase enzyme.

19 (b) 150 KJ

20 (d) Glycine and fat droplets.

21 (c) Active transport and permeability.

22 Xylem vessels and tracheids.

23 $FADH_2$

24 As the glucose molecule needs ATP molecule to be converted into glucose 6-phosphate, as well as fructose 6-phosphate needs ATP molecule to be converted into fructose 1,6-diphosphate.

25 The RBCs will shrink when the saline concentration is 1%, as they lose water, while they burst when the saline concentration is 0.5% and this happens due to the transfer of water molecules by osmosis from the highly-concentrated medium (low salts concentration) to the lower concentrated medium (high salts concentration) to inside the cells, which make them swell then burst, due to the absence of the cell wall in their structure.

26 **The statement is correct** / Because the blood flow in arteries occurs under high pressure, due to the thick pulsating muscular walls of arteries middle layer that contract and relax under the control of nerve fibers and they have endothelium topped with elastic fibers which provide the arteries with the required elasticity to pump the blood during ventricles contraction. But veins carry the blood under low pressure as they have thin muscular walls of their middle layer that can't pulsate and also their endothelium has rare elastic fibers and some of them have valves to prevent the backflow of blood, allowing its passage in one direction (to the heart), as the veins of the limbs that are present near the skin surface.

27 • Enzyme (1) : pepsin enzyme.
• Enzyme (2) : trypsin enzyme.

Answers of General Exam 5

1 (d) (4).

As cell (4) receives water from the two cells (2) and (3) which receive water from cell (1). So, cell (4) has the least concentration of water, therefore it has the highest concentration of salts before water transferring.

2 (d) The storage of the raw materials that are required to perform the photosynthesis process.

3 (c) The production of a large amount of NADH molecules.

4 (d) The closure of semi-lunar valves.

5 (c) The highest flow of water in the stem is delayed than the highest transpiration rate.

As the highest rate of transpiration is nearly at 8 o'clock am, then followed by the highest rate of water flow in the stem after nearly 10 o'clock am, because the water flow in the stem depends on the occurrence of the transpiration process.

6 (a) (1).

7 (b) They work at the same pH value.

8 (c) The rate of ATP molecules production will be affected.

9 (c) (2) & (3).

As the oxygenated blood is transported from the two lungs to the heart by vessels (2) "pulmonary veins", then coming out from the heart to the rest of the body parts through vessel (3) "aorta".

10 (c) The carbohydrates digestion continues.

11 (c) Specific enzymes.

12 (d) When it becomes equal to the pressure of water column in xylem vessels.

13 (a) Difficulty in the light passage.

14 (d) Youth - Elderhood - Childhood.

15 (c) Cells' membranes.

16 (c) Oxidative phosphorylation.

17 (b) Hepatic portal vein.

18 ⓑ W / X / Z / Y / Y ⟶ Z

As the semi-permeable membrane allows water to pass and as a result of high concentration of the solution in structure (Y), water is transferred to it by osmosis. So, the pressure in this structure increases, leading to the transfer of the sugar solution through the path (W) till reaching the structure (Z) and under this pressure, water comes out from the structure (Z), therefore this process continues until the sugar solution becomes in equilibrium state in (Y) and (Z), where adding an excess of sugar to structure (Y) and removing the excess amount of water in structure (Z) make the process continue in this pathway, in the light of this, (Y) can represent the leaves, because they manufacture the sugar, (W) represents the phloem as it is considered the path of sugar transport and (Z) represents the roots that transfer water through xylem vessels (X).

19 ⓑ The concentration of salts in the solution is more than their concentration in the blood cells.

20 ⓓ (L).

As the complete oxidation of one glucose molecule results in 6 CO_2 molecules, therefore cell (L) that contains 18 CO_2 molecules is the cell in which the oxidation of three glucose molecules takes place.

21 ⓑ Two macro-nutrients.

---

22 As "ptyalin" amylase enzyme works on the hydrolysis of starch into disaccharide (maltose), therefore it doesn't affect the mouth lining. While pepsin enzyme is secreted in an inactive form of pepsinogen from the stomach cells as it works on the hydrolysis of protein into chains of polypeptides, therefore if it is secreted in the active form, it will digest the cells lining the stomach which are made of protein.

---

23 The plant won't absorb water and mineral salts, therefore a great amount of nutrients won't be available. So, the plant will die.

---

24 380 ATP

25 **The statement is correct** / As the phloem translocates the manfactured food from the leaf to all the plant parts on the basis of "cytoplasmic streaming theory" which is affected by temperature and O_2, so that if the temperature decreases or in case of O_2 deficiency the cytoplasm movement and its streaming in the sieve tubes are delayed, leading to the delay of active transport process in the phloem.

---

26 The production of 2 molecules of NAD^+ again to allow glycolysis process to continue and produce more ATP molecules.

---

27 • (X) : pulmonary artery.
• (Y) : vena cava.

Answers of General Exam 

1 ⓓ Calcium.

2 ⓓ Each of them has an immunization function.

3 ⓓ Cambium.

4 ⓐ (1) is hydrolysis and (2) is catabolism.

As the presence of 38 ATP molecules in the products indicates the occurrence of aerobic respiration, i.e. (B) expresses glucose molecule that is broken in process (2) and this molecule is resulted from the hydrolysis (1) of disaccharide (A) which contains double the number of carbon atoms.

5 ⓒ A source for hydrogen that is required for the reduction process.

6 ⓑ Intercellular spaces ⟶ Cell wall ⟶ Plasma membrane ⟶ Cytoplasm ⟶ Plastid's membrane.

7 ⓓ O_2 from (B) to (A)

8 ⓐ The two statements are correct.

As the villi of the small intestine act on absorbing the digested food to pass into blood or lymph, while the convolutions of the large intestine act on absorbing water and some salts.

9 ⓓ The opening of semi-lunar valves.

As the number (110) represents the upper number when measuring the blood pressure which expresses the contraction of ventricles. So, the closure of the valves with flaps and opening of the semi-lunar valves happen.

10 ⓐ (1).

As the aorta contains oxygenated blood with the highest level of O_2 and the lowest level of CO_2

11 ⓓ Peptidase in small intestine.

12 ⓒ Starch.

13 ⓑ Both of them contain deoxygenated blood.

14 ⓑ Glucose / 3

15 ⓑ Diffusion and active transport.

16 ⓑ Energy consumption.

17 ⓑ Stopping the light and dark reactions.

As the transport of water to outside the vessel is stopped. So, it doesn't reach out to the leaf cells which leads to stopping the light reactions, therefore the dark reactions are also stopped.

18 ⓓ Artery / Vein / Blood capillaries.

19 ⓒ

To produce energy only, the aerobic respiration is occurred in which the fetus cells need one glucose molecule and 6 molecules of O_2 according to the following equation :

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$$

20 ⓑ Lack of O_2 in the soil.

21 ⓐ

As graph ⓐ illustrates obtaining energy from a glucose molecule in two stages, the first one is (glycolysis) the conversion of glucose to pyruvic acid in which the number of carbon atoms decreases into its half (3 carbon atoms) and the second one is the fermentation of pyruvic acid to lactic acid (3C).

---

22 To keep the greatest amount of water inside the plant cells by increasing the concentration of solutes in the solution. So, it can adapt to the surrounding environment.

---

23 Arrow no. (4) / Aorta artery.

---

24 *Answer by yourself.*

---

25 **The statement is wrong** / Because the vascular bundle of the stem contains cambium (not found in the leaf), in addition to xylem and phloem which are found in both stem and leaf.

26 **(a)** 38 molecules of ATP

(b) (3) / (2) / (1).

---

27 • (1) "Lacteal vessel" ⟶ Lymphatic system ⟶ Superior vena cava ⟶ Heart.

• (2) "Vein" ⟶ Blood capillaries in villi ⟶ Hepatic portal vein ⟶ Liver ⟶ Hepatic vein ⟶ Inferior vena cava ⟶ Heart.

Answers of General Exam 7



1 ⓑ (B).

2 ⓒ A higher percentage of CO_2 and a lower percentage of O_2

3 ⓑ 24

As the aerobic respiration reactions of one glucose molecule result in 10 NADH molecules and 2 $FADH_2$ molecules, where each of them carries 2 electrons according to the two following equations :

$$NAD^+ + H^+ + 2e^- \rightleftharpoons NADH$$

$$FAD + 2H^+ + 2e^- \rightleftharpoons FADH_2$$

So, the number of the removed electrons from one glucose molecule in the electron transport chain = 2 x 12 = 24 electrons.

4 ⓑ (2).

5 ⓑ Bicuspid valve and aortic valve.

6 ⓓ Left ventricle contraction.

7 ⓒ Cellulose.

8 ⓓ

As in tube ⓓ, there are snail and plant, where each one consumes the oxygen in the respiration process without the presence of a source of oxygen, due to the inability of plant to perform the photosynthesis process, because the tube is present inside black box that preventing light.

9 ⓓ Converting organic compounds into inorganic compounds.

10 ⓓ *Pinus*.

11 ⓓ It loses electrons.

12 ⓓ (X) & (Z).

13 ⓓ Each of them produces CO_2

14 ⓒ

15 ⓐ Water and salts absorption completely stops.

16 ⓐ An increase in the transport rate.



17 ⓓ (2) only.

18 ⓓ (C) ⟶ (A) and (B) ⟶ (A).

19 ⓑ Spongy tissue.

20 ⓒ 4

21 ⓐ ✓ / ✓ / ✓ / ✗

22 As vitamin (K) which plays an important role in the clot formation dissolves in fats that are transported through lymph.

23 The absence of sap vacuole (Y) from the root hair (X) affects the absorption of H_2O and salts by the plant root, as the vacuole is responsible for the regulation of water concentration inside the cell, therefore its absence causes a disturbance in the osmotic pressure inside the plant root cells. So, the root cells may rupture and the root become non-functioning, therefore the plant will wilt and die.

24 The conversions of ATP into ADP produce phosphate groups which enter in the formation of some compounds that are formed during glycolysis such as, glucose 6-phosphate and fructose 1,6-diphosphate.

25 Lactic acid / Because the blood clot which blocks the artery causes a deficiency in the muscle O_2 supply, therefore the muscle tissue performs anaerobic cellular respiration "acidic fermentation" leading to the accumulation of lactic acid in the muscular tissue.

26
- Dark reactions of photosynthesis process : it is used in building glucose, starch, proteins and lipids.
- Glycolysis process : it is used in cellular respiration as a high-energy compound.

27 Structure no. (1) / As the glucose molecules diffuse through the villi that are found in the small intestine to the solution in the container, while the glucose molecules can't pass through structure no. (2) "semi-permeable membrane", as it prevents the passage of sugar molecules.

Answers of General Exam 8

1 ⓒ CO_2 that is required to perform photosynthesis process.

2 ⓒ A decrease in the number of red blood corpuscles.

As the decrease in the number of red blood corpuscles is followed by a decrease in the haemoglobin level (suffering from anemia) and therefore a decrease in the oxygen level in blood. So, the body needs excess oxygen to increase the respiration rate that is accompanied by an increase in the heartbeats for pumping oxygenated blood in appropriate rate by the heart.

3 ⓓ The number of coenzymes (A).

As one coenzyme (A) can enter the Krebs cycle more than one time, while each acetyl CoA joins the Krebs cycle once. So, the released energy increases by increasing the number of acetyl groups and also by increasing the number of carbon atoms, where the breaking down of a large number of bonds among these atoms happens and by completing the electron transport chain, the stored energy in NADH and $FADH_2$ molecules is released completely.

4 ⓑ C ↓

5 ⓑ Dark reactions only.

6 ⓓ The innermost row of cortex.

7 ⓑ Vein.

As the blood passes in the vessel (3) with a low blood pressure which distinguishes veins.

8 ⓐ 1 : 5

9 ⓑ He can eat fats in small amounts.

10 ⓑ Imbibition.

11 ⓓ

As glycolysis process requires the presence of two ATP molecules. So, the storage decreases to 8 molecules, where the total produced energy of the glucose aerobic oxidation is 38 ATP molecules. Therefore, the total number of ATP molecules in the cell increases after the complete oxidation of glucose to reach 46 molecules.

12 ⓓ Cell (3) & Cell (5) / Cell (2) & Cell (4)

13 ⓒ 7 g

14 ⓑ (B).

As the glycolysis occurs in the cytoplasm that results in two NADH molecules and two ATP molecules.

15 ⓓ Meat. **16** ⓑ Hepatic portal vein.

17 ⓒ The dark reactions in both of them.

18 ⓒ Meat & juices. **19** ⓑ

20 ⓑ The concentration of cell sap of root cells.

21 ⓓ Opening of aortic valve.

22 Water is considered the source of hydrogen which is required for CO_2 fixation during the dark reactions of photosynthesis process.

23 Due to their large size.

24 • 2 NADH molecules. • 2 CO_2 molecules.
• 2 Acetyl coenzyme (A) molecules.

25

Blood capillaries in villi	Blood capillaries in alveoli
• A network of venous and arterial blood capillaries surrounding the lacteal vessel.	• A network of venous and arterial blood capillaries surrounding the alveoli.
• They are responsible for absorption of the digested food through the blood route.	• They are responsible for gas exchange between the alveolar air and the surrounding blood in the blood capillaries.
• They transport H_2O, mineral salts, monosaccharides, amino acids and water soluble vitamins through the blood capillaries to the hepatic portal vein then to liver and from it to the hepatic vein to be emptied into the inferior vena cava, then to the heart.	• They receive O_2 from the alveolar air and the bronchioles of the lungs forming oxyhaemoglobin "arterial blood" that transports O_2 to all the body parts. • They receive CO_2 from the body cells forming carbo-aminohaemoglobin "venous blood" that transports CO_2 to lungs to excrete it out of the body.

26 (a) To inside the tube.

(b) To absorb CO_2 that evolved from the plant respiration, therefore the volume of air inside the tube decreases. So, we can determine the rate of respiration by measuring the distance moved by the ink drop.

27 **The statement is correct** / As the stomach secretes the gastric juice which contains HCl that creates an acidic medium which helps in killing the harmful bacteria that may enter with food.

Answers of General Exam 

1 ⓑ In gastric juice. **2** ⓓ One Krebs cycle.

3 ⓑ 4 molecules.

As the produced energy is the total number of the resulted ATP molecules directly which are 2 molecules during glycolysis and 2 molecules from the Krebs cycle (when occurred twice).

4 ⓑ A blood vessel buried among muscles.

As the oxygenated blood with light red colour is found in arteries which are the blood vessels buried among muscles, i.e. the blood sample was taken from the artery.

5 ⓐ The water pressure decreases inside the leaf cells with increasing the transpiration process.

6 ⓓ The production of ADP from ATP in the stroma.

7 ⓐ Bile juice.

8 ⓐ From the alcoholic fermentation is greater than that from the acidic fermentation.

9 ⓐ Most of the released water from the leaf gets out through the stomata.

10 ⓒ The need for energy.

11 ⓑ Renal artery.

As the blood enters the two kidneys in the form of oxygenated blood through the renal artery and comes out in the form of deoxygenated blood through the renal vein, while the opposite occurs in the pulmonary artery, but in the hepatic vein and vena cava the blood enters the heart in the form of deoxygenated blood and comes out in the same form.

12 ⓐ Cambium.

13 ⓓ Active transport to the venules (venous capillaries).

As the starch is digested into monosaccharaides that pass in the blood route that are absorbed by active transport to reach the venules then pour into the hepatic portal vein.

14 ⓓ Plenty of O_2 inside the root cells.

15 ⓒ Circulatory system is closed, while lymphatic system is opened.

16 ⓐ Amylase and maltase.

17 ⓐ more than 
18 ⓒ

19 ⓐ NADH molecules give their electrons to the cytochrome at higher energy levels.

To release energy from the coenzymes (NADH & $FADH_2$), their electrons must be given to the cytochromes, where the more giving the coenzyme's electrons at higher energy level, the more increasing in the resulted energy.

20 ⓓ Plasma membranes and cellulose walls.

21 ⓒ 0.45%

22 Because the heartbeats rate changes according to the physical and psychological states of the body, since the sino-atrial node is connected to the nerve which increases the rate of heartbeats during performing a vigorous physical exercise to supply the muscles with enough O_2 to perform aerobic respiration to do their physical exercise.

23 The plant will wilt and die, due to the deficiency in the absorbed water and salts through the xylem vessels, as a result of decreasing the adhesion force between the xylem vessels and H_2O molecules.

24 If element (X) "$^{14}CO_2$" is supplied intermittently, dark reactions would take long time or wouldn't happen, because CO_2 is needed for the formation of glucose which is formed through several intermediate reactions, whereas the phosphoglyceraldehyde (PGAL) which is formed quickly "after 2 seconds" in the main experiment is used in building glucose. So, the nature of dark reactions can't be detected or revealed.

25 **The statement is correct** / Because the root gets O_2 dissolved in water which is absorbed from the soil by the root hairs during the absorption of mineral salts which need O_2 to be absorbed by active transport. So, the respiration rate increases.

26 • Because the medicine may be affected by the stomach acidity or it's difficult to be absorbed through the intestine.
• To reach the blood faster, as it enters the systemic circulation directly.

27 • (A) : Water level rises up, due to the evolution of CO_2 from the seeds respiration and absorbing O_2 gas, and soda lime absorbs CO_2
• (B) : Water level remains constant, because the dead seeds don't respire.

Answers of General Exam 10

1 ⓐ Stomach and small intestine.

2 ⓐ The oxidation of phosphoglyceraldehyde aerobically.

3 ⓒ Heparin.

4 ⓑ (Y).

As the concentration of element (Y) in the soil is less than that in the plant cells. So, the plant absorbs it by active transport which requires an energy that the plant needs in the form of ATP molecules that are resulted from the oxidation of glucose during the cellular respiration.

5 ⓓ Cambium.

6 ⓑ Increasing the surface area of the alveoli.

7 ⓓ Tricuspid valve and pulmonary valve.

8 ⓐ Artery.

As the blood passes in the blood vessel (1) with high blood pressure that distinguishes the arteries.

9 ⓑ It occurs inside the mitochondria.

10 ⓑ Diffusion.

11 ⓐ

12 ⓓ RBCs

As the living RBCs carry the oxygen on the haemoglobin that is present in them and transfer it from the two lungs to all the body parts, where after the breaking down of old red blood corpuscles, the body restores the proteins that are found in them to use them in the formation of bile juice which plays an important role in the digestion of fats.

13 ⓑ Oxidation.

14 ⓐ Pancreas.

15 ⓑ Sucrose moves by active transport from the mesophyll tissue of the leaves then to the phloem.

As it is obvious from the study of the curves, the concentration of sucrose in the mesophyll tissue is less than that in the phloem tissue, i.e. its transfer from the mesophyll tissue to the phloem tissue is against the concentration gradient and it is occurred by the active transport phenomenon.

16 ⓐ The presence of DNA molecules.

17 ⓓ The breaking down of chemical bonds among lactose molecules results in monosaccharides with high rate.

18 ⓑ (1) & (4).

As the vessels (1) carry deoxygenated blood that is pumped to the two lungs (i.e. they represent the pulmonary artery and its branches) and the vessels (4) carry oxygenated blood that is pumped to the different body parts (i.e. they represent the aorta and its branches). Therefore, the arteries carry the blood at high pressures.

19 ⓑ Water and salts transfer by capillarity phenomenon.

20 ⓓ

21 ⓑ Movement of chlorophyll molecule electrons.

22 Because the root hairs secrete viscous substance which helps them to find their way easily among the soil particles and also it helps them to stick to the soil particles, and so they can fix the plant into the soil.

23 2NADH = $3FADH_2$ = 6ATP

24 Liver.

25 **The statement is wrong** / As some glycerol and fatty acids may recombine again forming fats inside the villi, these fats pass into the lacteal vessels inside the villi, then to the lymphatic system which carries them slowly and empties them into the superior vena cava, then to the heart.

26 **(1)** The nature of dark reactions in photosynthesis.

(2) The role of sieve tubes in transporting the ready-made food substances to all the plant parts.

27 **(a)** Stages (1) and (3) represent the darkness.

(b) Curve (B) represent (^{16}O).